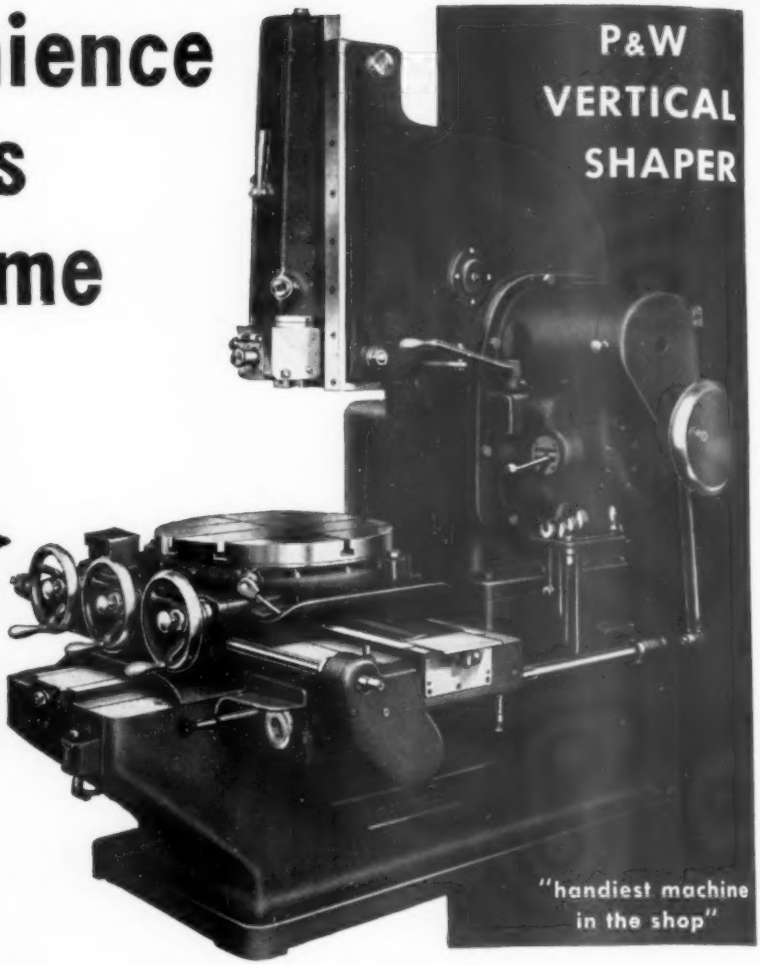
Vo

THE TOOL ENGINEER

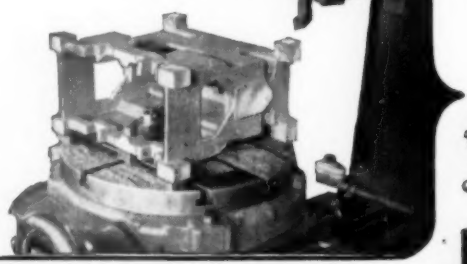
OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Behind every product that is mass produced is the tool engineer

Here is Convenience that Cuts Working Time



IN THE TOOLROOM



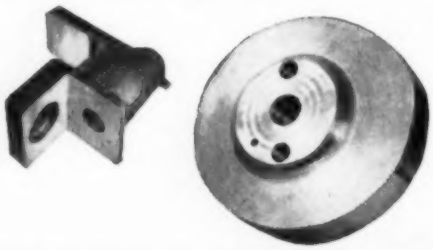
Thirty-five irregular slots and surfaces of this box jig were machined without a change in setup.

IN THE DIE SHOP



Irregular contours in this die and die-shoe were machined in 8¼ hours. How long would your present equipment require?

IN THE REPAIR SHOP



(Left) All machined surfaces reached without changing setup. (Right) Special cam-former, a one-time job, produced in 3 hours.

It's a pleasure to see a P&W Vertical Shaper in action and fully realize all it can do. Hundreds of foremen agree that it is "the handiest machine in the shop."

Here in one tool are combined longitudinal, transverse and rotary table feeds with a vertical ram motion. The possibilities of this combination have proved to be almost without limit.

It's easy to strap work in place on the horizontal table . . . easy to reach all vertical surfaces without changing setups . . . easy to follow the tool's progress along layout lines as it *enters* the work. Notice that all tool pressure is *down* against the solid bed. If you are machining a die, simply adjust the ram to the relief angle you want, and cut at that angle.

Look at the jobs pictured here. Then judge for yourself how the P&W Vertical Shaper can save time on *your* work. Write today for complete literature on "the handiest machine in the shop."

PRATT & WHITNEY

The Tool Engineer

Official Publication of American Society of Tool Engineers

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Oct., 1947

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Editorial

Always Something Better

MAN IS NEVER SATISFIED. It is a basic trait of human nature to be always wanting something, more or better, than what you have. Therefore, it is not surprising that this characteristic is especially dominant among Americans. We have more than any other nation; we want more. And there is no reason why we should limit our desires for new and improved products. In our physical resources, knowledge, skills, and industrial strength, we have all of the factors required to produce them.

On the basis of our experience in the past 25 years, it is safe to say that practically all of these new and improved products will result from some form of industrial research. There is no longer any question of its value. In the 25 years before the war industrial research increased tenfold. By 1940 it employed the services of 70,000 scientists and cost $300,000,000.

During the war its growth was phenomenal. It would be impossible to place a dollar value on the contributions of industrial research to the war effort. The knowledge and skills of its scientists and engineers, its facilities, and its great store of productive know-how were concentrated on the research, development and manufacture of the weapons and machines that gave us the best-armed, best-equipped Army and Navy in history. Working with academic and military groups, industrial research helped to make possible the elimination of the once-inevitable time lags in the progression from research-to-development-to-engineering or production-to-manufacture. As a result completely new devices were sent to our fighting men in record time.

However, industrial research need not rely on its spectacular war record alone for proof of its effectiveness. Of even greater interest in this period of reconversion to peace-time production is its accomplishments in the fields that affect our everyday lives.

Traditionally, industrial research has been devoted primarily to the perfection of applications of fundamental discoveries, made in academic or other non-commercial laboratories, to the needs of an industry. However, in industry today there is a rapidly growing tendency to the conduct or sponsorship of basic research. Its possibilities are unlimited. Whole new industries can be built upon its findings. For example, we have the new and important synthetic fiber and plastics industries, which are based upon chemical discoveries.

The role of the tool engineer in industrial research is a vital one. When the scientist in his laboratory makes a discovery, there is still a long, rough road to be traveled before that discovery finally results in a product on the everyday market. One of the biggest steps along this road is that taken by the tool engineer. After the physicists, chemists, mathematicians, engineers, and inventors make the basic discoveries, these discoveries must be put into a form suited to mass production and the tool engineer must figure out the machines which will manufacture the product.

As an example of what industrial research, largely engineering in character, has produced, let us look at the mechanical refrigerator industry. In 1926, 200,000 were manufactured and sold at $400 each. Ten years later 10 times as many were sold at a price of $160—and these were much better refrigerators. Within a decade both quality and quantity had increased sharply while prices decreased, because research had resulted in improved methods of production and new designs.

It is little wonder that industrial research laboratories now number more than 2,200 in this country. General Motors Corporation states that their research on diesel engines alone resulted in the placing in operation of four plants—one in LaGrange, one in Detroit and two in Cleveland—all in the 5-year period, 1934-39.

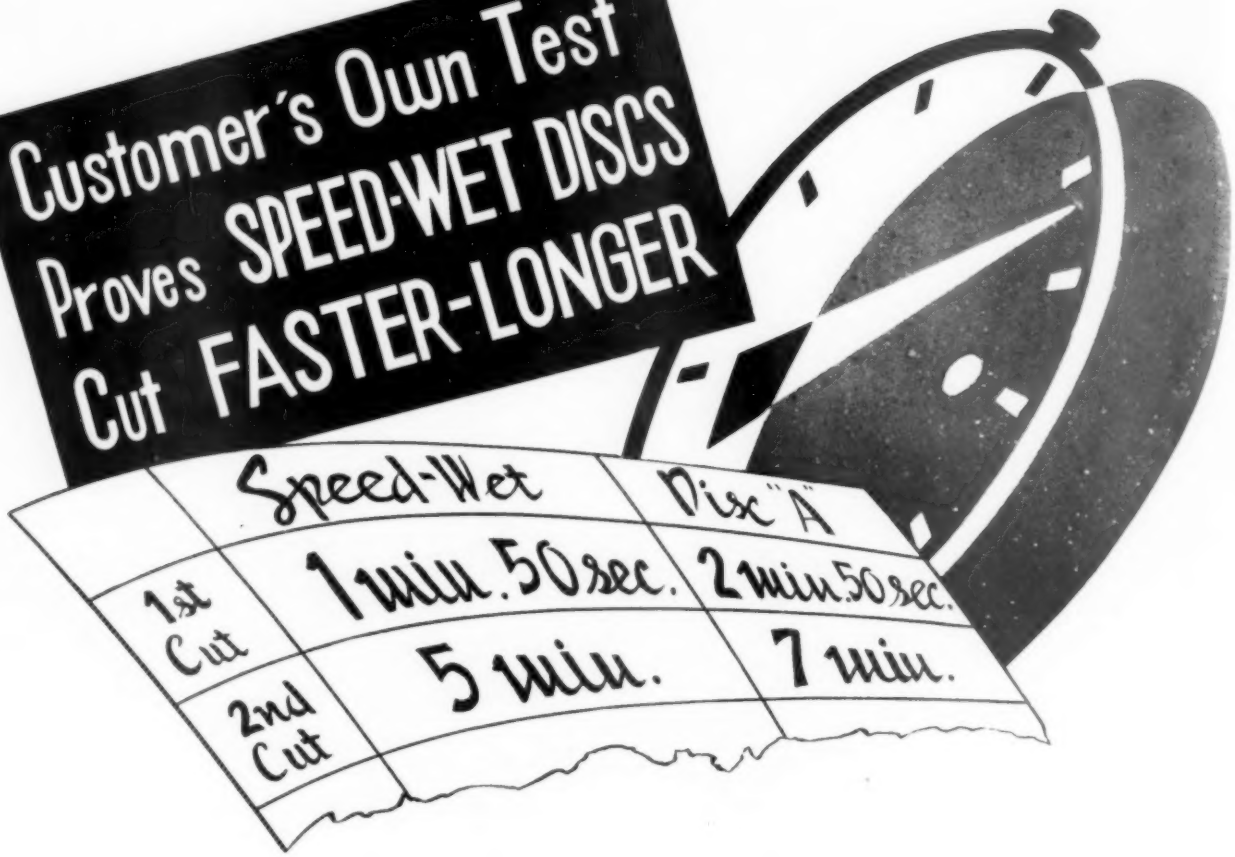
During the same period similar progress was reported in nearly all phases of industry. In the automobile field there were countless innovations, including the introduction of the automatic transmission, hypoid gears, and safety steel tops. In the steel industry there was the development of high-quality, deep-drawn steel sheets which made the safety tops possible.

For two centuries each generation has thought it was witnessing the peak of technological achievement. But the history of recent years shows us that we have actually made but slight progress in our climb toward the peak. It is the nature of science that each new discovery creates more problems than it solves. Solution of the new problems results in new products. Each new product opens another avenue for the wants of American people. And it will be the tool engineer who will make possible the mass production of these new products, and therefore make them available to most of the people at prices they are willing and can afford to pay.

W. B. Peirce

President 1947-48

Customer's Own Test Proves SPEED-WET DISCS Cut FASTER-LONGER



The test—fastest time to remove a specified weight of stock from a cold rolled steel bar—Speed-Wet Metalite Fibre Disc vs. leading competitive disc. Discs operated on portable grinder mounted in vise. Work pressure 7 pounds. Two cuts by each disc—first cut for initial cutting speed—second for sustained cutting speed after partial use. Time: First cut, Speed-Wet Disc—1 minute 50 seconds; competitive disc—2 minutes 50 seconds. Second cut, Speed-Wet Disc—5 minutes; competitive disc—7 minutes.



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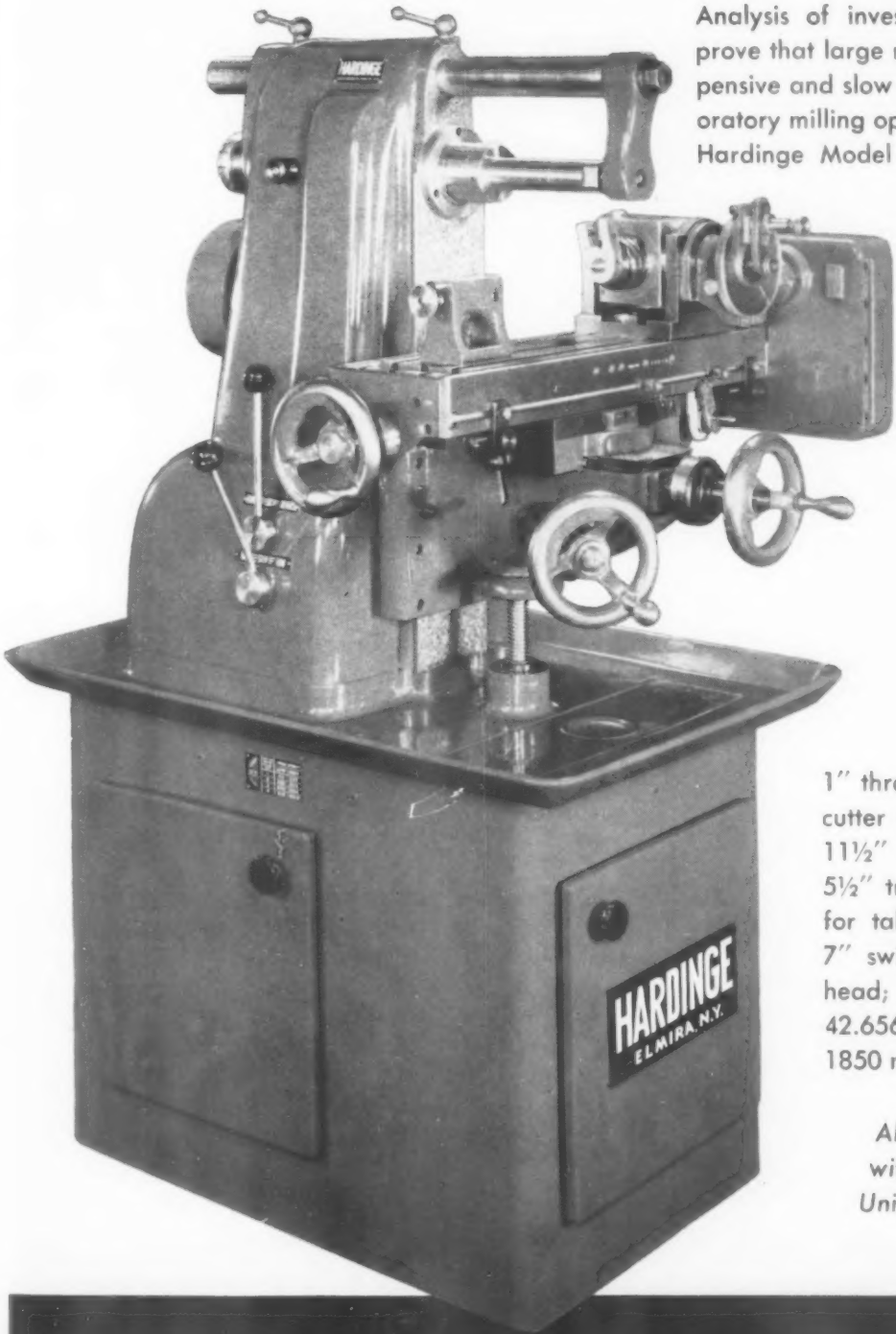
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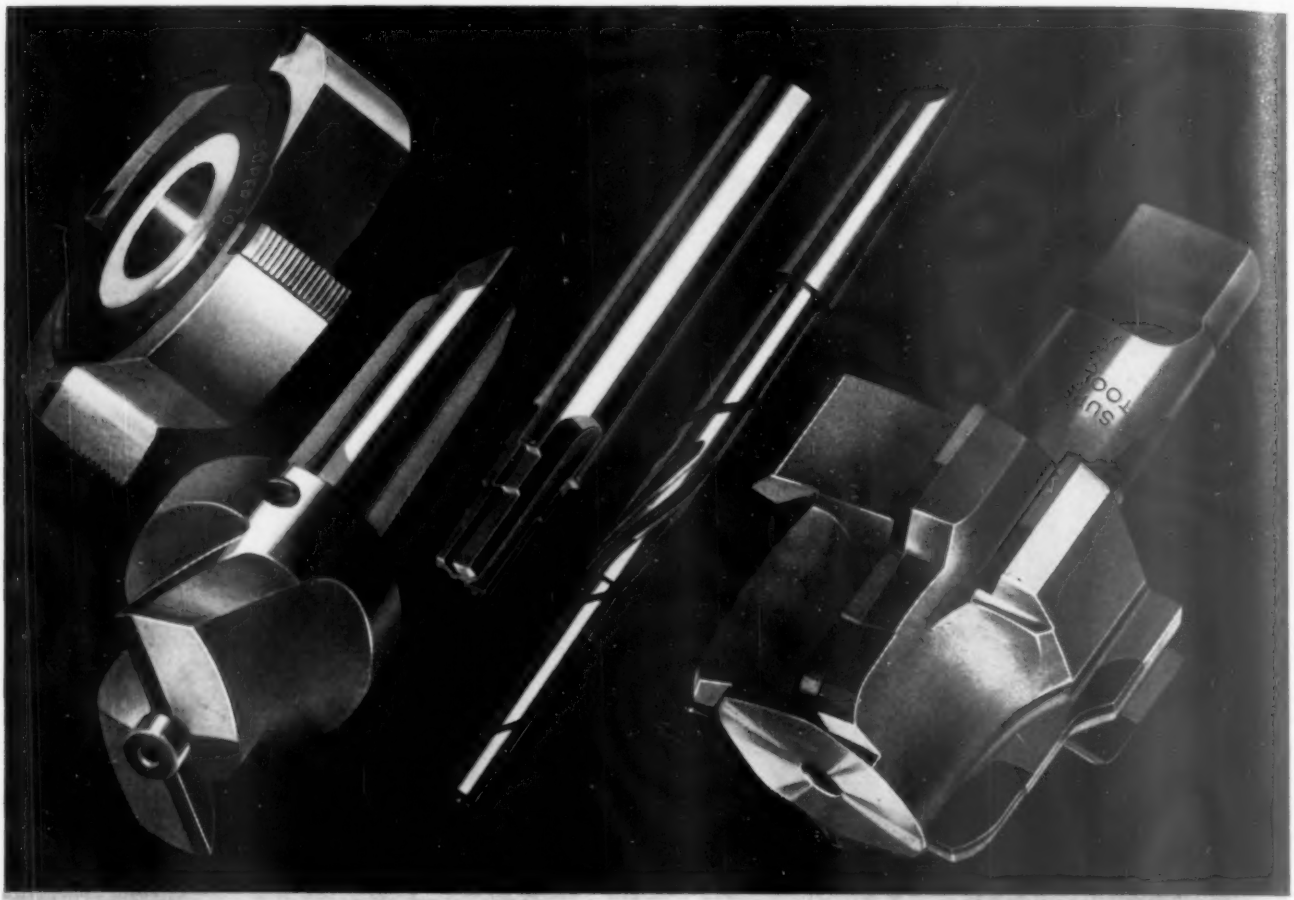
Specifications

1" through collet capacity for both cutter and dividing head spindles; 11½" longitudinal, 13¼" vertical, 5½" transverse travel; power feed for table ⅛" to 13" per minute; 7" swing universal spiral dividing head; spiral leads from .600" to 42.656"; eight speeds from 110 to 1850 r.p.m.

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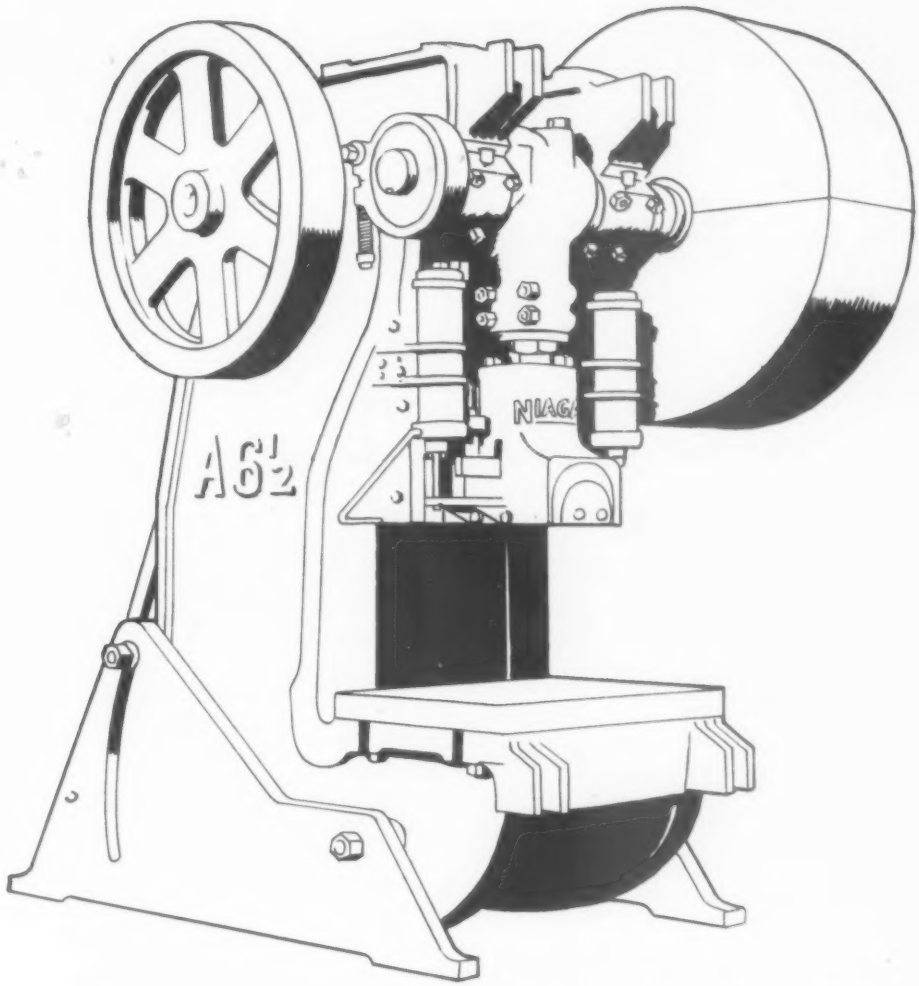
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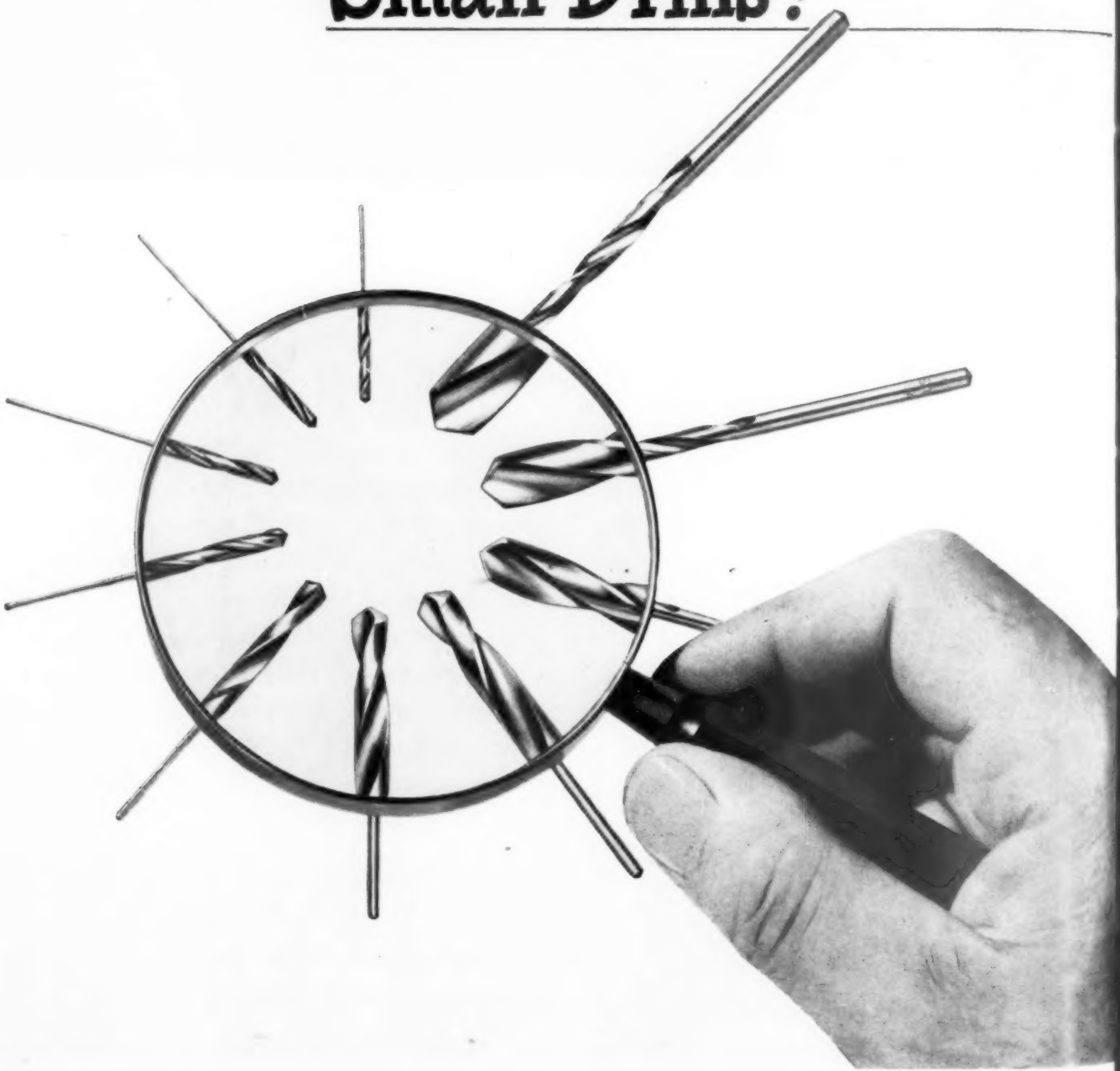
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Remember too, Morse small drills are *double-drawn* for increased toughness while maintaining their predetermined degree of hardness . . . and given special heat treatment to assure uniformity. Result: tools that appreciably lower small part production costs and step up "line" efficiency via *accurate* size holes drilled faster.

Whether your needs call for "bantam" size drills or the big Morse "block busters," Morse has the tool to cut down your costs. Your Industrial Supply Distributor can aid you in obtaining the proper Morse recommendation for *your* job on small or large drills and other high quality cutting tools.

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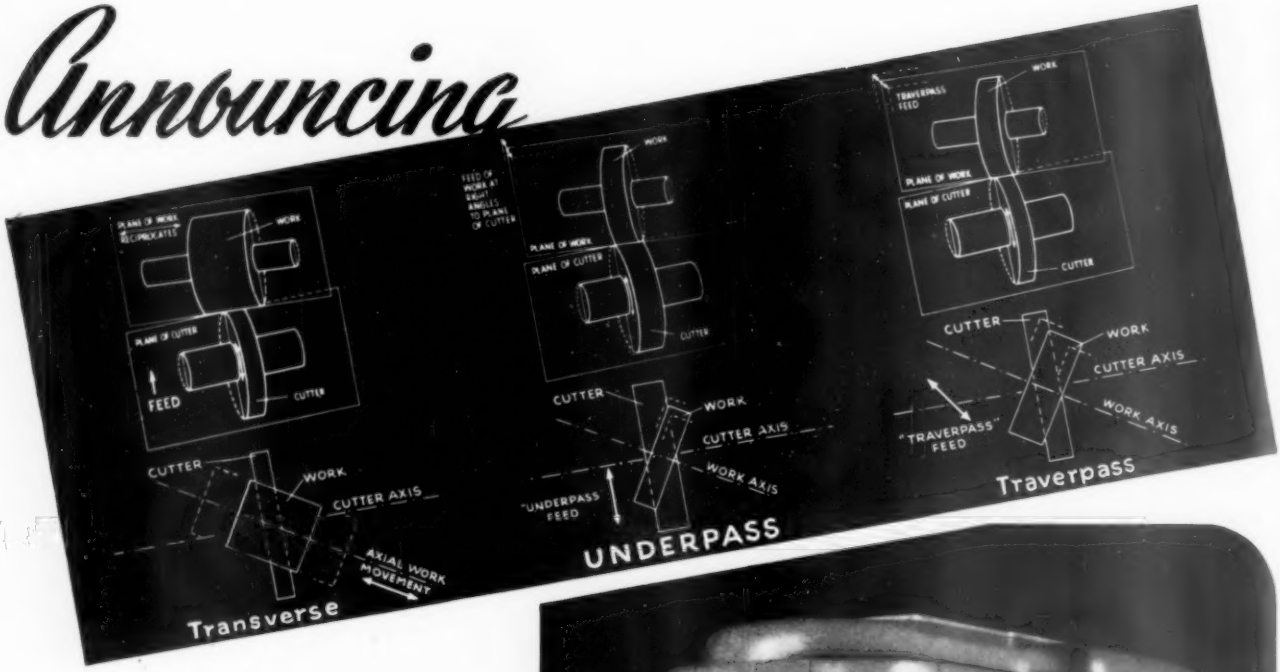
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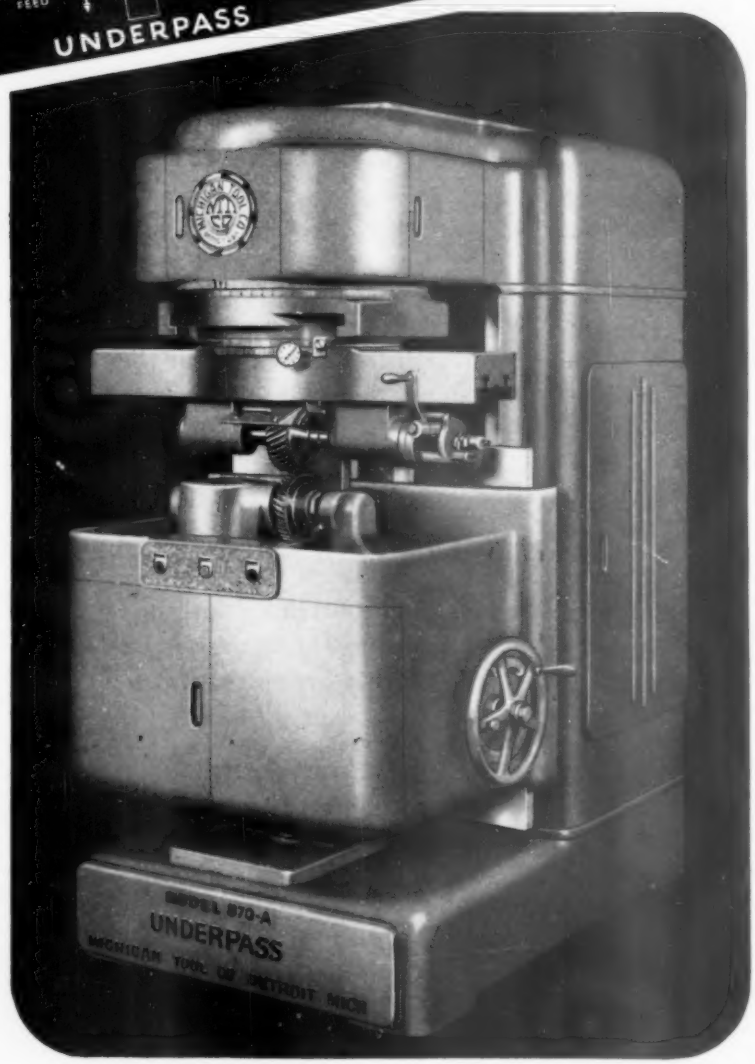
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MICHIGAN 870-A UNDERPASS

Gear Finisher



The new Michigan 870-A Gear Finisher not only brings UNDERPASS GEAR FINISHING to a new peak of accuracy, efficiency and speed (12 to 55 seconds, depending on the gear), but also makes available *in the same machine* two other pre-selective methods of gear finishing:

"Transverse" shaving for extremely wide face gears and splines and

"Traverpass" shaving for finishing fairly wide gears with narrow cutters (faster than "Transverse", although not as fast as "Underpass").

Also available (Model 870) without the vertical feed used with the transverse shaving process.

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FASTER SET-UP:

Merely rotate head-slide to select type of finishing method desired; all electric cycle controls in "sealed" dust-protecting compartment.

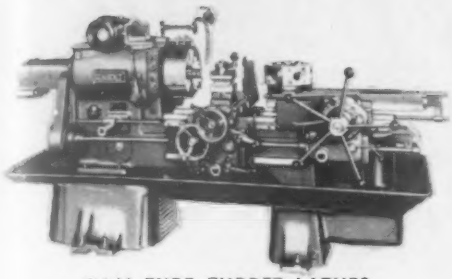
SMOOTHER OPERATION:

Head slide operated through Cone-Drive gearing (more teeth in contact—more contact per tooth).

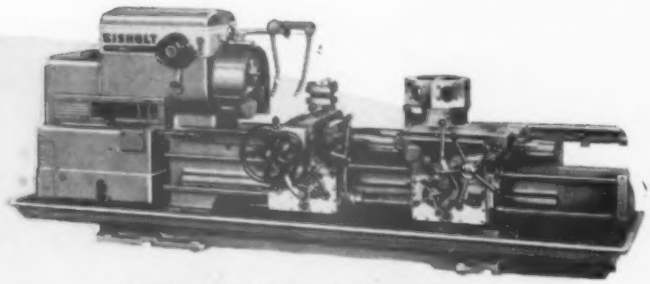
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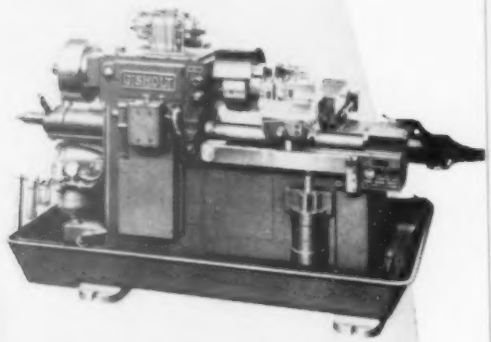
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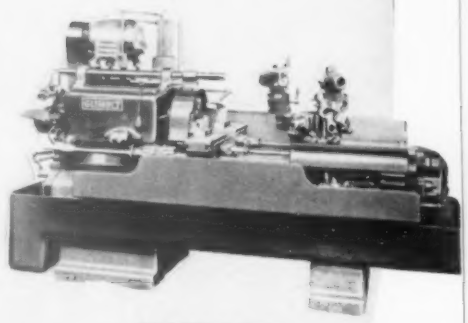
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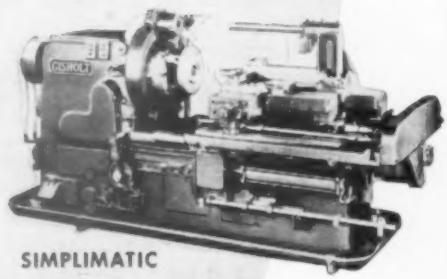
THE GISHOLT ROUND TABLE



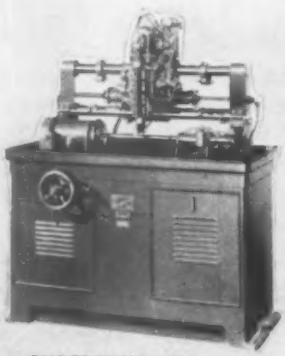
HYDRAULIC AUTOMATIC LATHES



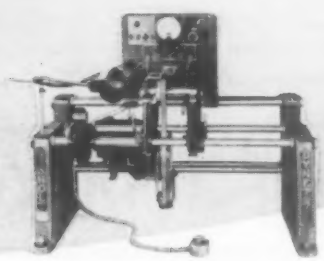
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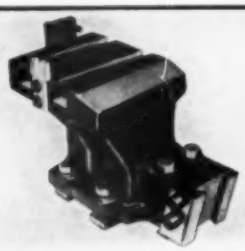
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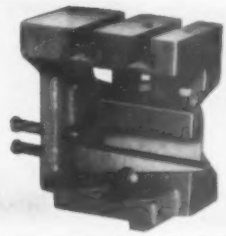
BALANCERS



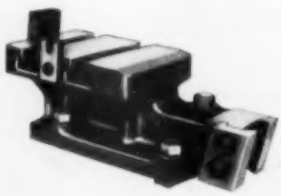
Double deck dovetail form tool holder for Acme-Gridley.



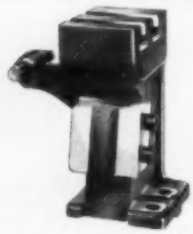
Double deck dovetail form tool holder for F or G Gridley.



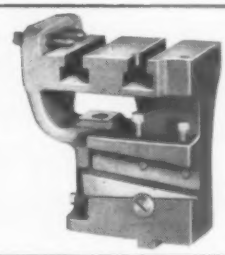
Double deck flat form tool holder for front position on F or G Gridley.



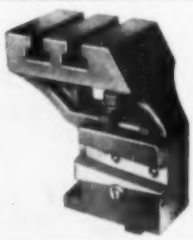
Double deck dovetail form tool holder for Acme-Gridley.



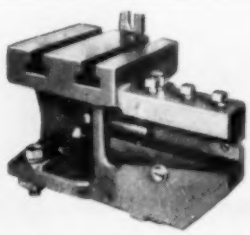
4th position double deck dovetail form tool holder with 3rd position cut-off for F or G Gridley.



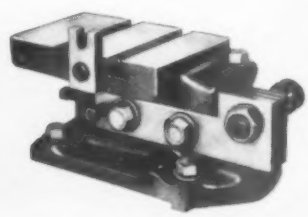
Double deck flat form and cut-off tool holder for F or G Gridley.



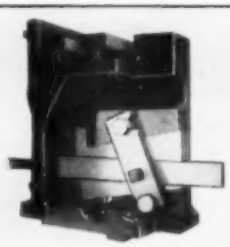
Double deck cut-off and shave tool holder for F or G Gridley.



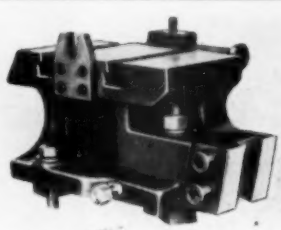
Double deck flat form tool holder for all Acme-Gridley.



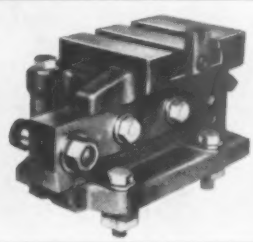
Double deck circular form tool holder for Gridley and Acme-Gridley.



Double deck flat form tool holder for front position on 1¾ to 2⅛ inch F or G Gridley.



Double deck dovetail form tool holder for Acme C Automatics.



Double deck circular form tool holder for Gridley and Acme-Gridley.

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The double deck tool holders shown here are but a few of the 400 items which comprise the SLITTER line of standard automatic screw machine tool holders. Included in our complete line are flat form, dovetail, and circular forming tool holders for C Acme, F or G Gridley, Acme-Gridley, New Britain Gridley, Greenlee, and Cone automatics. The selection is so wide and varied that you will find our standard holders capable of meeting 90% of all your requirements.

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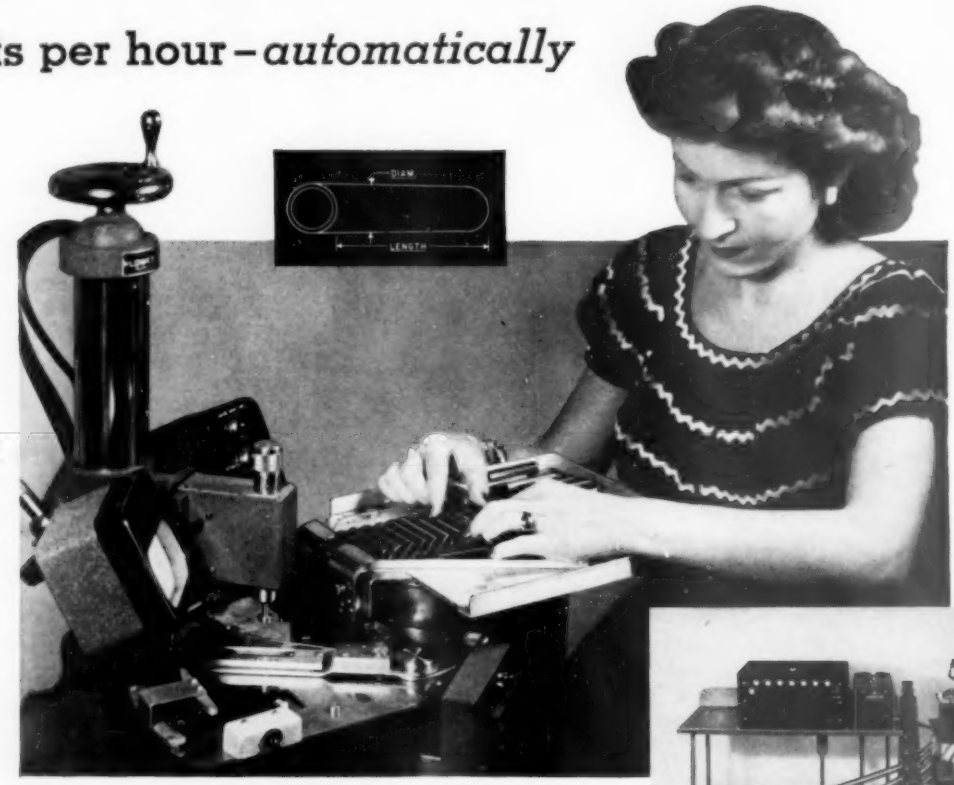
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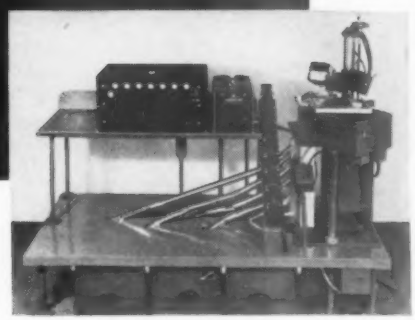
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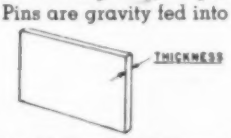


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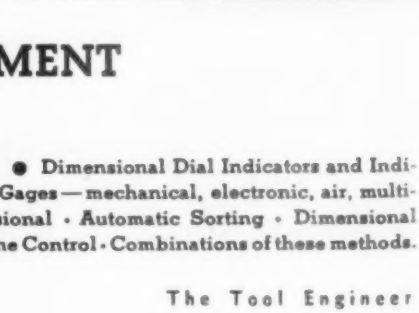
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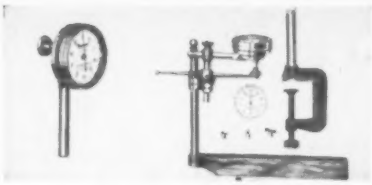
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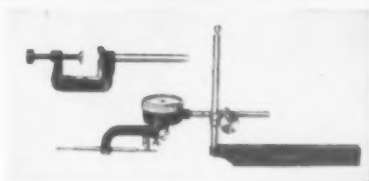


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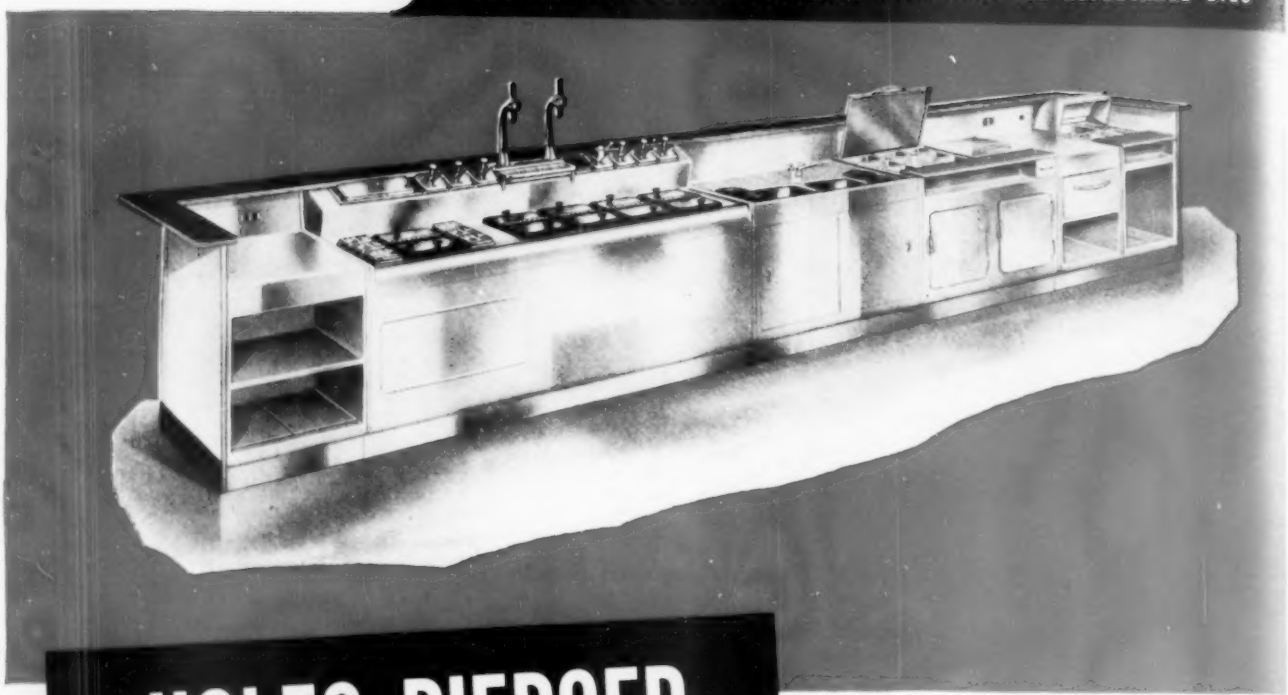
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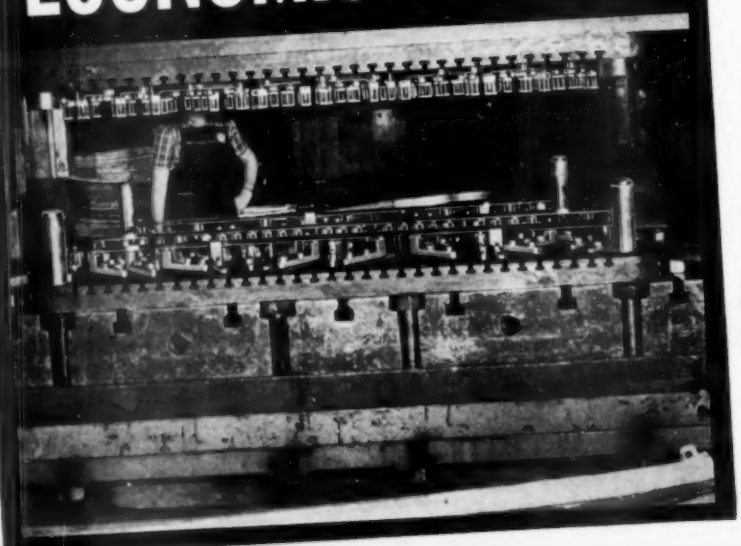
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SAE Involute Splines and Applied Involutometry

In which the mathematics of the Involute Spline are reduced to plain terms

By Merton W. Seavey

PART ONE OF TWO

THE 1946 SAE HANDBOOK has in it a section on the subject of 30-degree pressure angle Involute Splines. This work is a masterpiece of coordinated engineering—the culmination of a number of years of study and practical application which includes the "know-how" of producing and using involute splines. Its range is sufficient to cover all general engineering and mechanical applications and particular attention is given to the automotive and aeronautical applications.

A native of Haverhill, Mass., *Merton W. Seavey* is Standards Engineer with Lockheed Aircraft Corporation, Burbank, Cal. Active in ASTE work since joining the Society several years ago, he is incumbent Standards Ch'man, Los Angeles Chapter. His article on the Involute Spline, in which there is currently a lively interest, may be considered an outstanding contribution to the "know-how" of tool engineering.

It provides for three types of fits—major diameter, sides of teeth and minor diameter, and for three classes of fits in each type—sliding, close and press. These involute splines are already in use in many plants, and it is hoped they will be used more and more since they provide interchangeability and ease of manufacturing, which all add up to a better product for less money. (See Sk. I.) *

In applying these SAE Standards to actual manufacturing conditions, the author has been asked many questions by people of various manufacturing concerns in Los Angeles who either manufacture spline parts, tools or gages, and from people within the various departments such as engineering, production planning, tool engineering, inspection, machine set-up men, and machine operators. These questions, which reflected genuine interest in the subject, caused the author to wonder: "If there are so many people interested in the subject of splines in only one city, then there must be many more throughout the nation. Therefore, perhaps I can do my fellow engineers a good turn by shortening the learning time required to master the subject."

This article is written in language and terms equally understandable to graduate tool engineers, trained shop men, and to those without the benefit of having attended institutions of higher learning and who have not yet acquired the necessary knowledge of higher mathematics. It is written to bridge the gap between practical and theoretical knowledge.

To facilitate study of this subject, the information presented in this article will be found under the following headings:

DIVISION I: Objective
DIVISION II: Introduction to SAE Involute Splines
DIVISION III: The Involute Curve and Spline Teeth
DIVISION IV: Measurement of Angles, Trigonometry and Radians
DIVISION V: Directory of Spline and Gear Terms by Diagrams and Symbols
DIVISION VI: Application of Radians to SAE Formulas of Splines
DIVISION VII: Definition of Words Related to Splines
DIVISION VIII: Manufacturing and Gaging Problems
DIVISION IX: Bibliography

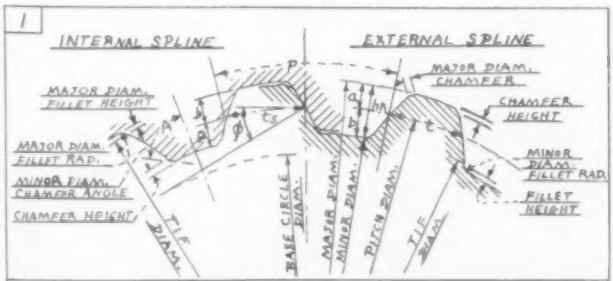
DIVISION I: *Objective*

(a) To explain in shop language the subject of involute splines as applicable to the 1946 SAE Standard. This includes the interpretation of the formulas as used to establish the values listed in the various tables. (b) To provide sufficient fundamental data to enable the reader to continue his study of splines, or to branch over into gearing.

DIVISION II: *Introduction to SAE Involute Splines*

In reading this article, you will find it much more interesting if you have available a copy of the SAE 1946 Handbook.** It is not the intention of the author to completely copy all the data given in the SAE Handbook; indeed, that would serve no practical purpose as one could be referred to it. However, let us call this Division II a book review, with the comments supplementing those given in the handbook, which are necessarily brief. It would be well to first observe the Index and Foreword to the Standard for Involute Splines in the SAE Handbook. The balance of the subject is divided into *Sections* 1 through 20, *Tables* 1 through 27, *Figs.* 1 through 11, and *Appendices* 1 through 8. Throughout the rest of this article, when referring to the SAE Handbook, it will be done by using the phrase "Ref. Section—", etc., rather than to the handbook page number, inasmuch as page

*Sk. numbers will be found in upper left or right corners of illustration.



DP-DIAMETRAL PITCH
p-CIRCULAR PITCH
a-ADDENDUM
b-DEDENDUM
h_w-WORKING DEPTH
c-CLEARANCE
t-CIRCULAR TOOTH THICKNESS
t_s-CIRCULAR SPACE WIDTH
ϕ-PRESSURE ANGLE
C-MEASUREMENT OVER PINS -EXTERNAL
G-MEASUREMENT BETWEEN PINS -INTERNAL
N-NUMBER OF TEETH
D-PITCH DIAMETER
D_b-BASE CIRCLE DIAMETER
D_c-MAJOR DIAMETER-INT.&EXT.
D_R-MINOR DIA.-INT.&EXT.
TIF-DIA. AT JUNCTION OF INV. FORM WITH FILLET
d_x-MEASURING PIN DIA. -EXTERNAL
d_m-MEASURING PIN DIA. -INTERNAL

**This article was written prior to the 30° Involute Splines being published as an American Standard; however, the following standard is now available, ASA B 5.15 - 1946, Involute Spline, Side Bearing. Approved by American Standards Association, but published by the American Society of Mechanical Engineers, 29 West 39th St., New York 18, N.Y. $1.00 per copy.

numbers are often changed in succeeding issues. By giving reference in this manner, this article will complement the SAE Standard on Involute Splines. When referring to any drawing used in *this* article, the phrase "See Sk—" will be used. Thus, the reader will know whether to look for an illustration in this article or refer to the SAE Handbook.

The nomenclature used agrees as nearly as possible with the standard gear nomenclature adopted by the American Gear Manufacturers Association and the American Standards Association, except that the words outside diameter and inside diameter have been changed to major diameter and minor diameter to avoid confusion.[1] It is also interesting to note that the basic dimensions for both the external and internal splines are seven in number. They are the pitch diameter, circular pitch, circular tooth thickness, addendum, dedendum, major diameter, and minor diameter. Also of importance is the fact that because of the almost universal practice of broaching the internal spline, *it has been held to basic dimensions*, and the *external spline dimensions varied to control the fit*. This corresponds to the general practice of fitting to a reamed or drilled hole because of the fixed condition of the finishing tools and gages.[2]

Tolerances Determined From Experience

It is also important when studying the main Tables 5 through 21 to remember that some data is basic, some inversely proportional to the one/two pitch data, and that the tolerances are determined from manufacturing experience and not by proportions.[3] For formulas or dimensions not determined by proportioning and for tolerances used, refer to Table 22. The table dimensions have been rounded off by increasing the last figure retained to the next larger when the following figure is 5 or more.[4]

The measurement of tooth thickness is actually determined by measuring over pins for the external spline, and between pins for the internal spline. It is not necessary for the pin to contact exactly at the pitch circle. It might be well to note that the measurement with pins will only check *one* element —the tooth thickness—and that this in itself will not guarantee interchangeability. Other elements, such as spacing errors, must be determined by other means.[5]

Types of fits are major diameter, sides of teeth, and minor diameter. Also, in each type, there are three classes of fits—sliding, close, and press. The committee which set up this combination of types and fits very cleverly identified them so that, by simple reference to the class, one would automatically know the type.

By merely referring to Class A in the following table, the type can be determined.

TYPE	MAJOR DIAMETER	SIDES OF TEETH	MINOR DIAMETER
CLASS OF FIT	SLIDING I CLOSE II PRESS III	SLIDING A CLOSE B PRESS C	SLIDING X CLOSE Y PRESS Z

The only exception to this occurs if the Full Fillet type for aeronautical use were required, then the words "Full Fillet" should be added after the class.

A key to tables and column numbers is provided. It is labeled "Table 1." Its primary use is to guide one in selecting the proper columns to be used in the main tables, depending on which class of fit is being used. You see, the main tables are complete; they contain data for *all* the various classes of fits. Therefore, it was necessary for the committee to establish a key to the tables and columns depending on the class of fit selected. This key, Table 1, will be found in Ref. Section 10.

[1](Ref. Section 2.) [2](Ref. Section 5.) [3](Ref. Section 7). [4](Ref. Section 7.)

Sk. 1 shows a chamfer on the addendum of the external and internal splines. This chamfer is required only on Class I, II, III and X, Y, Z, and provides clearance for the fillet on the mating part when using the major or minor diameter bearing type of spline. It does not appear when using the aeronautical full fillet type of spline.

The standard also reminds one of the importance of using uniform methods to show complete information on detail drawings.[6] At this point the author would like to interject the observation, based on many years in the shop, on the drawing board, checking, and purchasing plant equipment and tools, that the greatest source of trouble and expense is the omission of needed data on the drawings rather than outright errors or mistakes.

It should not be overlooked that the series of spline diameters is based on the inch system, which makes it convenient to apply to standard shafting and tubing. For those who have to use them in connection with metric ball bearing bores, a convenient table is provided.[7]

In order to determine the amount of circular clearances or interferences which occur when using class A, B, or C fits, a convenient table is also provided for this purpose.[8]

Product tolerances for class A, B, and C, for circular space width and tooth circular thickness are provided in table form.[9] The main tables give only one dimension for over or between pin measurements. The other one has to be calculated according to the notes in the column headings and the E or F factors.

In order to help one to see just what size a given diametrical pitch is, a series of actual size drawings along with the diametrical pitch and a table of important tooth dimensions are included.[10]

Examples for Formulas

Whenever one wishes to check the data in the main tables or, for some reason, to deviate from the standard spline dimensions, such as using a different diameter pin, the committee has included the formulas necessary along with an example for each.[11] & [12] For those who do not have the SAE Handbook available, Sk. 25 and 26 are essentially the same. Certain functions of the formulas have already been completed to six places to the right of the decimal point. This is a great convenience and further indicates thorough planning. Important constants, as well as the formula for the E and F factors, are included at the end of Table 4.

Appendices 1 and 2 give certain data on cutting tools, hobs and broaches. Figs. 6 and 7, on "hobs" and "broaches" respectively, also give the necessary data for the full fillet type of spline for aeronautical use.

Appendices 6 and 7 consist of engineering suggestions. A table of external basic measurements over the pins, with a pin diameter of dx=1.9200/DP, is provided.[13] This table can be used in conjunction with the E factor for determining the clearance.

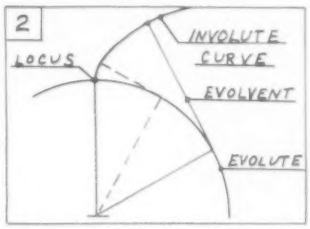
DIVISION III: *The Involute Curve and Spline Teeth*

Perhaps it will be best to start with Webster's definition: "Involute (geom.) A curve traced by any point of a perfectly flexible inextensible thread kept taut as it is wound upon or unwound from another curve (called the evolute), or the path of any point of a tangent that rolls without sliding round a curve, called also evolvent." (See Sk. 2.) It is the innermost part, of this involute curve, in which we are interested inasmuch as it applies to the teeth of the spline. We therefore have our first of several propositions. Proposition No. 1—The base circle is the evolute.

[5](Ref. Section 8.) [6](Refer Section 14.) [7](Ref. Table 3.) [8](Ref. Section 19.)
[9](Ref. Section 20.) [10](Ref. Table 2.) [11](Ref. Fig. 4 "External".)
[12](Ref. Fig. 5 "Internal".) [13](Ref. Table 27.)

In Sk. 1, under "spline tooth nomenclature", you will find that certain symbols have been given to represent various parts of the spline. This is necessary as the part names are too cumbersome to use in the formulas and on drawings.

In studying the involute, it might be well at this time to call attention to the base circle in relation to Sk. 2. The reason for this is because all involutes originate or start from a base circle. Therefore, it can be said (Proposition No. 2) that for any involute there is only one base circle, and (Proposition No. 3) that for any base circle there may be an infinite number of involutes.



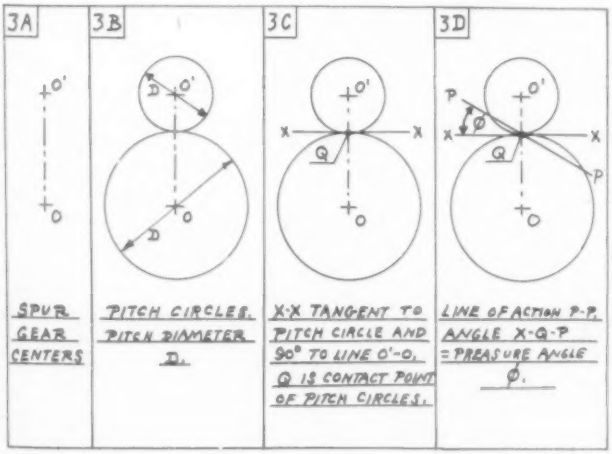
We have previously said that it was the innermost part of the involute curve in which we were interested, and this is very true as will be established later in this article. The section of the involute curve which is actually used in the spline tooth varies, however, depending on the number of teeth in the spline. This is due to the location of the base circle in relation to the teeth of the spline e.g., the greater the number of teeth, the further they are away from the base circle and, as you have learned, all involute curves start from the base circle. (See Sk. 2.)

External Spline Similar to Spur Gear

The foregoing calls for further explanation because it evokes the question, "How is the base circle determined? What is its function?" This calls for another statement, viz.: —that to all practical purposes the external spline is similar to a spur gear, and so, for the balance of this article, it will from time to time be necessary to refer to spur gears—or to fundamentals of gearing—to put over the point desired.

Right now, we are on the subject of the base circle. However, we have to back-step to a few basic gear fundamentals, which can be explained as follows: Turn to Sk. 3A, and let us start out by establishing a couple of spur gear centers, labeled O'-O. Sk. 3B shows the pitch circles, and the diameters of these circles are called the pitch diameter, symbol D. Fig. 3C shows a line O'-O drawn through the two gear centers, also a line X-X drawn tangent to the pitch circles at the point where they contact each other, labeled point Q. Naturally, this line X-X is also 90° to line O'-O.

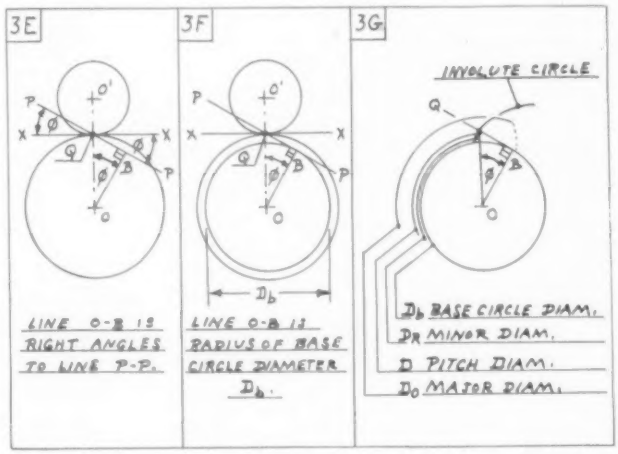
Sk. 3D shows a line P-P which is called the line of action. The angle between the lines X-X and P-P (defined as angle X-Q-P) is called the pressure angle, symbol ϕ. Sk. 3E shows a line O-B. This line originates at the gear center O and joins line P-P at point B, and is always a right angle at point B. From this same sketch you may learn that pressure angle symbol ϕ is often located on drawings of individual gears in places other than between angle X-Q-P. Because line X-X



In Sk. 1, under "spline tooth nomenclature", you will find right angles to line P-P, it follows that the angle Q-O-B is also the same as the pressure angle X-Q-P and is referred to as such.

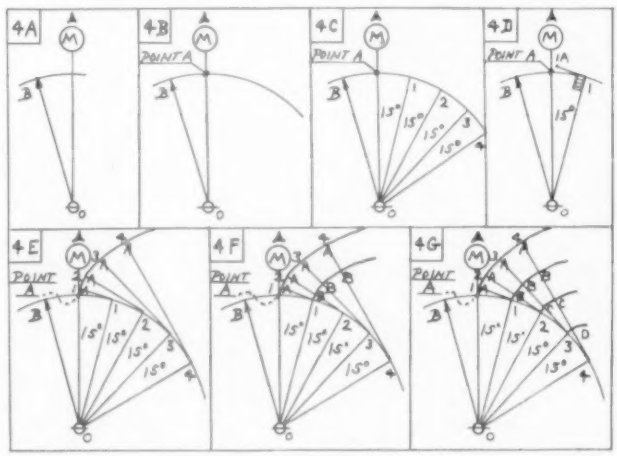
Sk. 3F shows a circle constructed by using the line O-B as its radius. This circle is called the base circle, and its diameter is called the base circle diameter, symbol Db. It is, of course, that circle from which the involute curve originates which forms the tooth shape.

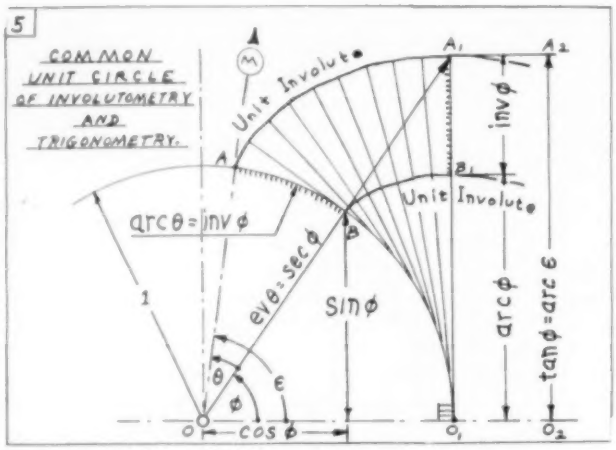
Sk. 3G has been simplified to show only one gear or spline. The angle Q-O-B has been retained and the pressure angle ϕ shown. Two new items have been added, viz: the major diameter symbol, Do, and the minor diameter symbol Dr. This sketch also shows an involute curve, originating at the base circle and passing through point Q and continuing on past the major diameter. Of course the only section of the involute curve which is used in this example is the section between the major and minor diameters.



In a later installment (Sk. 27 and 28) you can locate the base circle Db and see again how the tooth shape becomes a part of the involute curve. You will notice that, on the spline with only 8 teeth (Sk. 27), the base circle is greater than the minor diameter while, in the spline with 50 teeth (Sk. 28), the base circle Db is some distance inside of and away from the whole gear tooth. Now, if you have diligently studied the foregoing data, you should have a good understanding of what the base circle is, and how it is determined and why it is necessary. You should also have a good understanding of the relation of the involute curve to the gear tooth.

At this point, it may be well to go back and study more about the involute curve itself. In order that values can be





established and tabulated for the involute curve, the subject has been developed around the value of one, and the unit of inches, and is called the "Common unit circle of Involutometry and Trigonometry."

The definition of "Unit Circle" is a circle whose *radius* is one unit (one inch, one foot, one centimeter, etc.,) depending upon what system of measurement is being used. In this article the unit used is the inch (″).

Just what the reader will get from studying this article will depend, to a large extent, on the interpretation of the words used. The writer knows, from experience, that shop people are not, as a rule, too familiar with the less common technical terms; hence, he has included Division VII—"Definition of words related to splines"—for reader convenience. Use it frequently.

Let us now study how the involute curve is developed. We will start at Sk. 4A with two known things, the radius O-B and the line O-M called the "Pole". Sk. 4B shows a part of a circle whose radius is O-B. Where the circle crosses the pole, we will now label point A. Sk. 4C shows several lines equally spaced at 15° and labeled 1, 2 and so on. Sk. 4D shows a straight line 1-1A, which is the same length as the arc of the circle from point 1 to A. This line is also at right angles to the line O-1, and therefore tangent to the circle. These facts form the basis for Proposition No. 4—the tangent of the base circle is always perpendicular to the involute curve.

Sk. 4E shows straight lines drawn tangent to lines 2-3-4, and of the same length as the arc of the circle from point A to the number of the line. A curved line drawn through points 1A, 2A, etc., is the involute curve. Next, let us draw another involute curve (Sk. 4F) from line 1 on the circle whose radius is O-B. As this second involute cuts across the tangent lines the points of intersection have been labeled B. It will now be noted that the lines 1-1A, 2B-2A, etc. are exactly the same length. This is also shown again in Sk. 4G. The lines 4AB, 4BC, 4CD, and 4D to tangent of circle are all equal in length. This is true as long as the angular spacings remain equi-distant, such as spline teeth are. From studying the foregoing, we arrive at Proposition No. 5—all involutes made to the same base circle are congruent and equi-distant.

It would be well, at this time, to bring all of the propositions together for review:

Proposition No. 1—The base circle is the evolute.

Proposition No. 2—For any involute, there is only one base circle.

Proposition No. 3—For any base circle there may be an infinite number of involutes.

Proposition No. 4—The tangent of the base circle is always perpendicular to the involute curve.

Proposition No. 5—All involutes made to the same base circle are congruent and equi-distant.

Now, be prepared for some axioms. In Sk. 5, the common unit circle has been drawn. Now, first consider the angles. The angle drawn from the horizontal line O-O_1 to the line O-B is the pressure angle, ϕ (Phi). Next, the angle A-O-B is called the polar angle, θ (Theta), as it is always adjacent to the pole. Next, the angle from the horizontal line O-O$_1$ to the pole is called the roll angle, $\hat{\varepsilon}$ (Epsilon). From this we can now say that the pressure angle, plus the pole angle equals the roll angle, and is written thus: $\phi + \theta = \hat{\varepsilon}$.

The line, from points B to B_1, forms an involute curve. Next, note that subscripts have been added after the letters. This is done so that various points can be identified. Note that the line O_1-B_1 is equal to the length of the arc of the pressure angle, that it is tangent to the radius O-O_1 and, also, that it is a 90° angle. If we now extend the radius line O-B until it intercepts an extended line from O_1-B_1, we will arrive at point A_1. The extended line O-A_1 is called the radius vector.

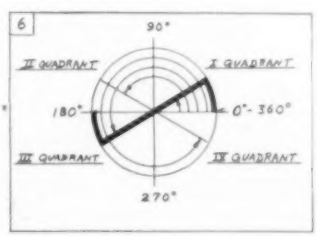
Now, if another involute curve is drawn through point A_1, it will meet the base circle at point A. You will now realize that the length of the line B_1-A_1 is the same as the length of the Arc B-A. We can therefore say that the arc of the pole angle equals the pressure angle of the involute, and you will find it written in Sk. 5 that the Arc θ = Inv. ϕ. Next, note that the tangent lines, Arc ϕ (O_1-B_1) plus the Inv. ϕ (B_1-A_1) equals Arc $\hat{\varepsilon}$ (O_2-A_2).

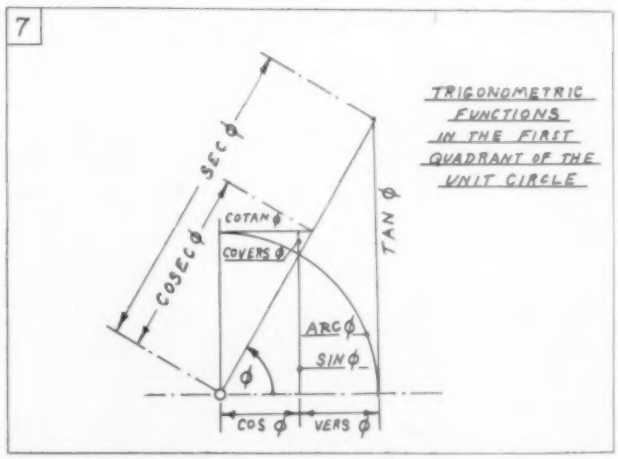
Let us now summarize and say it in abbreviated form, remembering that the word "arc" is symbolized thus $\frown$: (1) Inv. $\phi + \theta = \hat{\varepsilon}$ (2) Inv. $\frown\phi + \frown\theta = \frown\hat{\varepsilon}$.

Common Unit Circle Found by Trig

For a few minutes let's forget the involute and go back to good old shop trig. For just a moment see Sk. 6, wherein the quadrants of the circle are shown; then turn to Sk. 7 for the trigonometric functions as they appear in the I Quadrant of the unit circle. If you care to, you can compare these with any handbook, such as *Machinery*, *American Machinist* or the *Tool Engineers Handbook*. Now if you will compare Sk. 7 to Sk. 5 you should be able to understand why the latter is titled "Common Unit Circle of Involutometry and Trigonometry."

By comparing the trigonometric terms you will see that Sk. 5, line O_2-A_2, is the same as the tangent of the pressure angle and is labeled tan ϕ. Next you will note that the radius vector, line O-A_1 bears the same relationship as the secant in trigonometry and has been labeled Sec. ϕ. Also notice the relationship for other parts such as the sin ϕ and the cos ϕ.





You will find we have discussed everything on Sk. 5 except one item. Located on the radius vector, line O-A1 are the words ev $\theta = \text{Sec. } \phi$; the only part of which we haven't studied is the ev θ. Now the symbol "ev" stands for the word evolvent, and the evolvent is shown in Sk. 2, and the definition will be found in the Dictionary of Terms, Division VI. Do not let this cause you any confusion at this point; let us hasten to say that ev θ stands for a function, the evolvent function of the pole angle.

Three Important Angles

Now in involutometry there are three important angles which occur simultaneously on each involute. They are the pressure angle of the involute ϕ, polar angle of the involute θ and the roll angle of the involute ξ. It would be much easier to explain if the length of the radius vector Sk. 5, O-A1 were to grow in length a constant amount for each deegree change of the pressure angle.

However, the polar angle and length of the radius vector are variable to the pressure angle, and it was necessary to invent the evolvent function and apply it to the unit circle in order to establish values for it.

In order to stay within the outlined scope of this article, the writer asks the reader to accept what has been said, or if the reader wishes to go further with the study of Involutometry, then a good teacher, plus the book "Involutometry and Trigonometry" should be consulted. (Ref. Division IX Bibliography.)

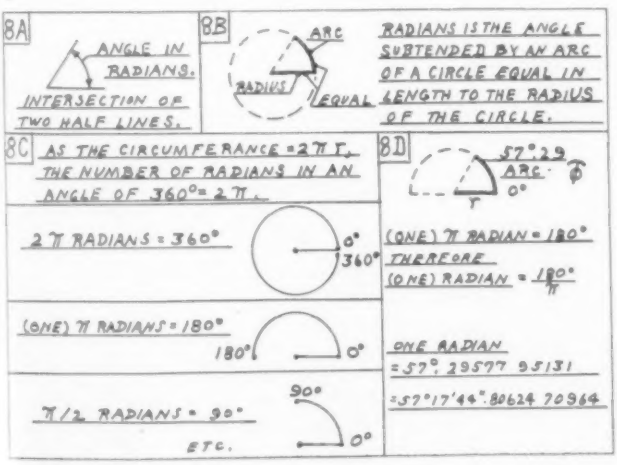
The Angle in Relation to the Circle

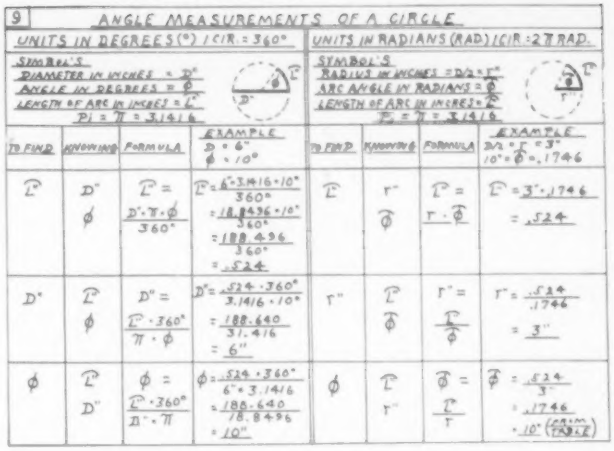
DIVISION IV: *Measurement of Angles—Trigonometry and Radians*

One of the most common parts of trigonometry used by shop men is the angle, most commonly used in relation to the circle. And it is this relationship with which we are most interested here. Now, the unit of measurement most widely used and understood by shop men is the degree, the 360th part of a circle which, in accordance with the sexagesimal measure of an angle, (Ref. Division VII, Definition of Words) is further subdivided into minutes and seconds.

Since, here, we are primarily concerned with splines, we are naturally interested in the angular spacing of the teeth around the pitch circle, the relationship of various tooth parts, and the relationship of the involute curve to other circles such as the major diameter, minor diameter and particularly the base circle. When it comes to applying the sexagesimal measurement of an angle to gear teeth, however, one soon discovers that it is slow and troublesome to deal with the units of degrees, minutes and seconds.

A compromise is often used, using the degrees, but subdividing them into hundredths. This is written as (example)





12°.84. The tables approved by the American Gear Manufacturers Association are written in degrees and hundredths of a degree, rather than in degrees, minutes and seconds.

Now there are other units with which to measure angles, but shop men are less familiar with them. There is, for instance, the mil unit, used chiefly by the U. S. Artillery. (Ref. Division VII, Definition of Words.) There is the radian unit, sometimes called "circular measure" but here referred to as radian. It is ideally suited for the measure of angles used with splines or gears. Realizing, however that the unit of radians will be new to many shop men, and that others may want to review it, it will be explained sufficiently for an understanding of its application to splines and gears.

Signs and Symbols Different

Before we study the radian, bear in mind that the signs or symbols used in algebra are different from those used in arithmetic. The plus (+), minus (-) and equal (=) signs remain the same; however, the multiplication sign (x) is reduced to a dot (example $a \cdot b$ or $2 \cdot \pi$). The division sign (÷) is seldom used; either the numerator is placed over the denominator or a diagonal line is put between the numerator and denominator, thus: (4/2).

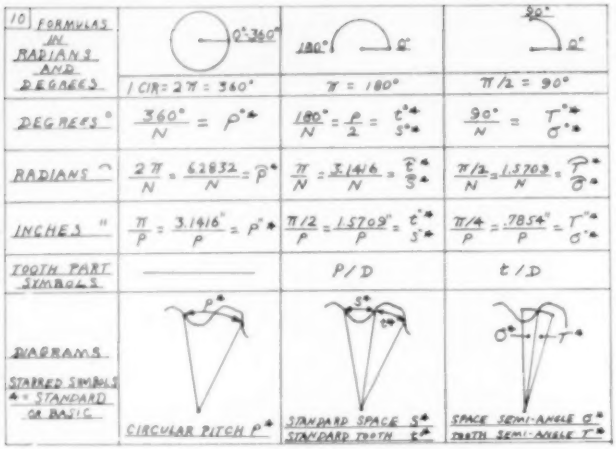
Now let us examine Webster's definition of the radian: math. (1) the natural unit of measure of the angle between two intersecting half lines, or (2) the angle from one half line to another intersecting half line; (3) it is the angle subtended by an arc of a circle equal in length to the radius of the circle; (4) as the circumference of a circle is equal to 2π times its radius, the number of radians in an angle of 360° (or in a complete turn) is 2π.

Let us now interpret the definitions in the form of diagrams. Sk. 8A shows definition (1) and (2). Sk. 8B shows definition (3). Sk. 8C further describes definition (4). Sk. 8D further describes the relationship of the radian to the circle and also gives the values of a radian, both in decimals and in degrees, minutes, seconds and decimals of a second.

For convenience in comparing the two systems, a chart of angular measurement of a circle is shown in Sk. 9. The example used in Sk. 9, 6" diameter and 10° angle is the same for both systems; study them and see the simplicity of doing the example using radians.

Inasmuch as the formulas used for splines and gears call for the angles in degrees and hundredths of degrees (mentioned before as approved by A.G.M.A., it is suggested that the reader obtain conversion tables from degrees to radians. One of the most convenient tables for conversion of degrees and hundredths to seven place radians is "Involutometry and Trigonometry."[14] In these tables the degrees and radians are arranged in adjacent columns.

[14](Ref. Division IX, Bibliography.)



We can now apply radians to splines or gear teeth. Do not forget, when discussing the number of teeth in a spline, that it also includes a space, and the two combined are referred to as circular pitch. (Ref. Sk. 1.) Example: If we wanted the angle in degrees between adjacent teeth of a spline with 10 teeth, we would simply divide the number of degrees in a circle, by the number of teeth, and it would be done thus $360°/N = 360°/10 = 36°$.

Now, if you wanted the angle of the tooth thickness (assuming that the tooth thickness and tooth space are equal) you would divide the number of degrees in a circle by the number of teeth, and then divide the answer by 2. It would be written $360°/N/2$. This can be simplified by rearranging the formula and dividing the degrees in the circle by one half (2) and then dividing by the number of teeth, and is simply written $180°/N$. Now, for your convenience, let us set this all down in table form, and also include the radians.

Degrees	Radians	
$\frac{360°}{N}$	$\frac{2\pi}{N}$	= Circular Pitch, Tooth and Space
$\frac{180°}{N}$	$\frac{\pi}{N}$	= Tooth or Space Thickness
$\frac{90°}{N}$	$\frac{\pi/2}{N}$	= Tooth or Space Semi-Thickness

Now, using the previous example of 10 teeth and desiring the circular pitch angle in radians, it would be written: $2\pi/N = 2 \cdot 3.1416/10 = 6.2832/10 = .62832$, and you can then convert the radians into degrees from the tables. Actually, isn't it just as easy to solve the problem using radians as using degrees?

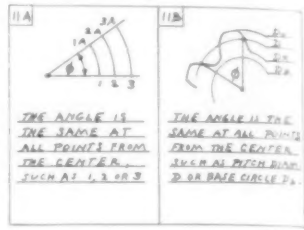
A "Refresher" in Geometry

Assuming that you have now learned some things about radians, we'll take a "refresher" in geometry. In plane geometry, it should be remembered every circle (360°) is divided into halves (180°) and quarters (90°). The quarter circles are called quadrants and are numbered as shown in Sk. 6, where you will notice some crossed lines, a part of them in heavy section. They represent, graphically, the relation of radians to the *diameter* of the circle.

Remember in Sk. 8B, where the radian is shown in relation to the *radius* of a circle, and the angle is approximately 57°; well, if this arc were to be divided in half and the upper half were rotated around into the III Quadrant, we would now have what is shown in Sk. 6 in the heavy outline.

From this, we can now see the relation of half a radian to the *diameter* of a circle, which is approimately 29°. Keep this in mind, as it will be useful later on. It will save the trouble of dividing the diameters of a circle by 2 in order to obtain the radius of the circle when used in formulas.

Next, let us consider some other things about angles. See Sk. 11A. If it is true that the angle is 30° between points 1-1A, then it is also the same angle between points 2-2A and 3-3A or any other distance from the center. This same reasoning, when applied to various parts of spline or gear teeth is shown in Sk. 11B.



If the angle is 30° at D, then it must also be 30° at Db. All this leads up to the statement that, in gearing, it is necessary to find some common denominator into which to reduce the various parts of gear teeth, in order that they can be added, subtracted, and otherwise calculated. The easiest way is to convert or reduce all problems into terms of angles in radians on the *base circle*.

Now turn to Sk. 10. Here is a table of formulas, with sketches to aid in applying that which has already been learned to spline or gear teeth. The symbols have been changed from those used on splines to those used for gearing, such as the tooth space symbol in splines being *ts* while that for the gear is *S*. So far as this article is concerned, they are one and the same and may be used interchangeably.

Whenever a *standard* or basic value for tooth part is desired to be identified, the starred (★) symbol is used. It should be understood that a gear made to standard or basic dimensions will not function satisfactorily because provisions must be made for errors in manufacturing, with further allowance for oil or grease. This is usually done by thinning down the teeth an equal amount on both the pinion and the gear; however, sometimes when critical conditions arise, the designer may want to leave the teeth in the pinion standard and provide for all the backlash in the main gear.

In the case of splines, the amounts of thinning is extremely small as it is desirable to keep the angular backlash to a minimum. Also remember that with splines, all the teeth are in mesh at the same time, whereas in gears only two or three teeth are in mesh at any one time. The foregoing should be sufficient to acquaint the reader with the subject of radians, so, let us go on to the next division.

End of part 1. Part 2, starting with Division V, will follow in November *The Tool Engineer*.

Neoprene-Covered Electrical Cords

A NEW LINE of portable electrical cords, introduced by the United States Rubber Company, features a heavy-duty neoprene rubber jacket which provides increased protection against abrasion and other damage. Designed to withstand extreme flexing, constant movement, and surface abuse, the new cords are especially suitable for use on tools, portable lamps, sound equipment, and domestic electrical products, as well as other electrical equipment.

The over-all diameter of the cord has not been affected by a 30 to 60% increase in the thickness of the jacket. This is made possible by insulating the individual conductors in the cord with Laytex, which is applied by a dipping process. This produces a thinner insulation with superior physical and electrical properties.

The new cables will be available in sizes 10 to 18, with 2, 3, or 4 conductors and with or without steel wire reinforcement. The cables will be distributed under the name U.S. Royal Master Cords.

By **Thomas A. Dickinson**

Report on Die Casting

In which the author explains the principles of hot and cold chamber methods

DIE CASTING MAY BE DEFINED as a method of casting or pressure-forming molten metals in metallic molds. It is the ancestor of our much publicized plastic-injection molding processes, and is the only technique whereby a vast number of metal articles may be efficiently mass-produced by molding.

The history of die casting has been traced back to 1849, when the type-casting machine shown in Fig. 1 was invented by J. J. Sturgiss. The purpose of the Sturgiss machine was to force a molten lead alloy from a pressure chamber and through a nozzle into a mold or die by means of a plunger mechanism, and its principles laid the foundation for the modern printers' linotype.

During the Civil War, die casting played an important role by enabling Yankee manufacturers to produce huge quantities of lead bullets. Fig. 2 shows a refined version of the Sturgiss machine, which probably facilitated such production.

Until about 1907, virtually all die-casting machines were manually operated. Then, Van Wagner patented the so-called hot-chamber (or "gooseneck") machine, shown in Fig. 3, thus establishing a basis for a major portion of our modern die-casting industry.

In the Van Wagner machine, air pressure served as the force which caused molten metals to enter a closed steel die. Molten alloys were ladled into its gooseneck prior to each machine operation, the quantity each time being slightly more than enough to fill the die. Air pressure, carefully regulated to conform with the requirements of the die by experimentation, was then applied to the metals in the gooseneck. This eliminated variations in the quality of casts due to variations in the manual pressure used to operate earlier machines.

Nevertheless, the first die-casting machine to be placed on the open market, sometime later, was the manually-operated Soss Machine, shown in Fig. 4. It was used extensively in the manufacture of metal door hinges, and had several operational features which made it more dependable than the original Van Wagner machine.

Until 1912, the potentialities of die casting were somewhat limited because lead and tin were considered the most useful alloys for the work. Therefore, much of our current die-casting success can be attributed to the development of castable alloys based on zinc, aluminum, magnesium, and copper.

Two Essential Methods

There are two essential methods of die casting, respectively known as "hot-chamber" and "cold-chamber" processes. The hot-chamber method includes those techniques whereby an injection cylinder is immersed in molten metal so that direct air pressure or pressure from a ram can be used in filling the dies. The cold-chamber method includes those techniques whereby separate injection chambers and metal-melting pots are used so that the chambers must be loaded, either manually or automatically, prior to each operation or "shot." Usually, the die cavity is filled by means of ram pressure.

The author wishes to extend thanks to H. L. Harvill, President of Harvill Manufacturing Company, Corona, Cal., and to the Hydraulic Press Manufacturing Company, Mt. Gilead, Ohio, for courtesies extended in the preparation of this article.

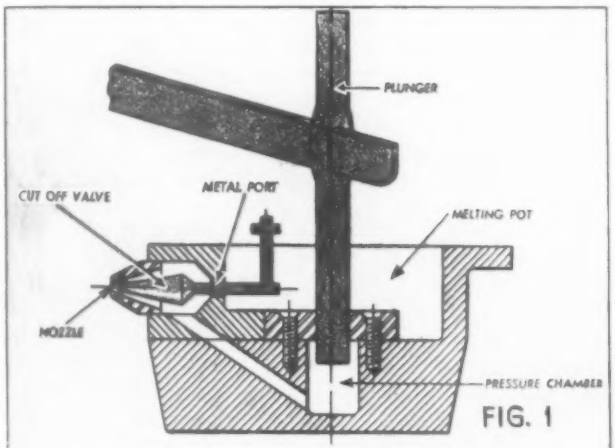


FIG. 1

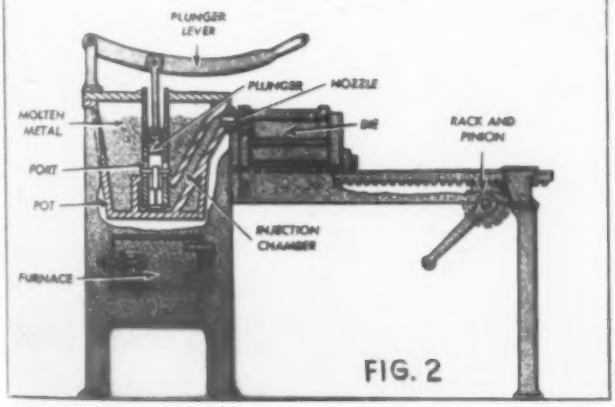


FIG. 2

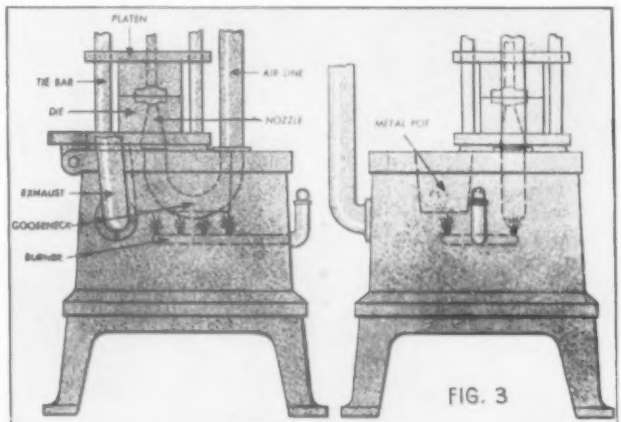


FIG. 3

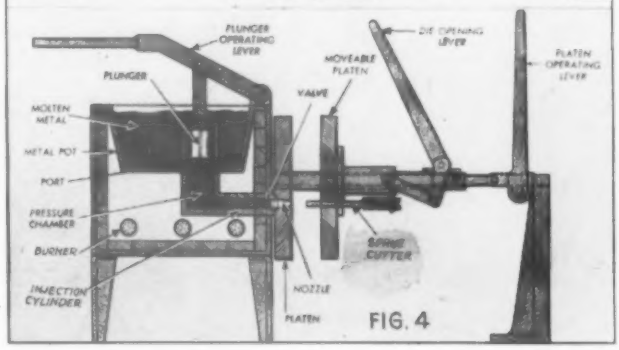
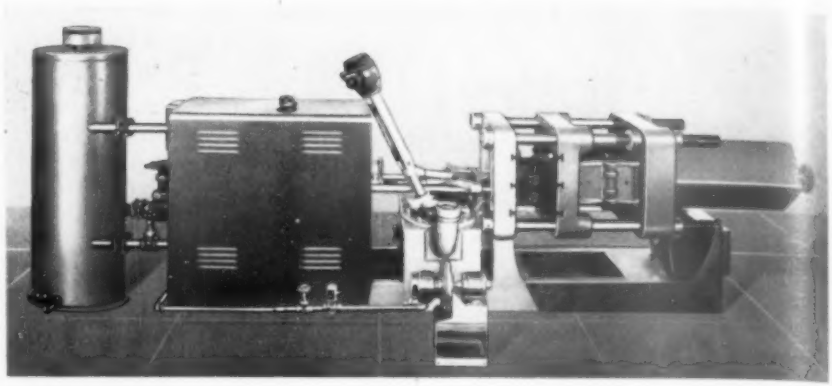


FIG. 4

FIG. 5A—Harville Model HD 302 Die Casting Machine shown tooled for hot chamber operation. Photo by courtesy of H. L. Harvill Mfg. Co., Corona, Cal.



Generally speaking, it might be said that hot-chamber die casting is limited to comparatively low-pressure work whereas cold-chamber machines may use up to 100,000 psi pressure. However, hot-chamber machines are eminently satisfactory for the production of zinc, tin, and lead alloy products.

Figs. 5A, B and C show typical "gooseneck" machines now so widely used for hot-chamber die casting. Its essential members include a melting pot, an injection chamber, an injection nozzle, die platens, the machine frame with tie bars, a die operating cylinder, and two die halves (which are not actually part of the machine, since they are interchangeable).

Beneath the melting pot is a burner chamber, normally fired by oil or gas. Ingots of a required alloy are usually fed by hand into the melting pot, which is part of the machine, but may be ladeled to the pot from a separate metal-breakdown furnace.

The injection chamber is generally a cast-iron-alloy cylinder, mounted so that its gooseneck will be immersed below the surface of the molten metals in the melting pot, and so that its injection opening will be in contact with the injection nozzle which leads through the stationary platen of the machine and into the die cavity. Either a pneumatic or hydraulic cylinder may be used to open or close the dies, hydraulic cylinders being generally preferable even though they are somewhat more expensive than air cylinders. Operating cycle is shown in Fig. 5D, below.

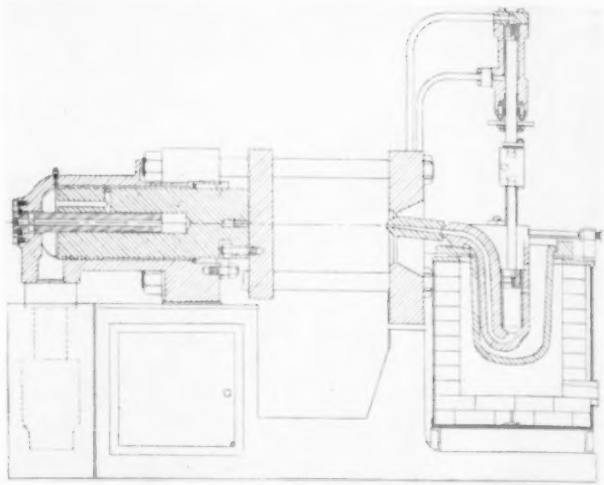
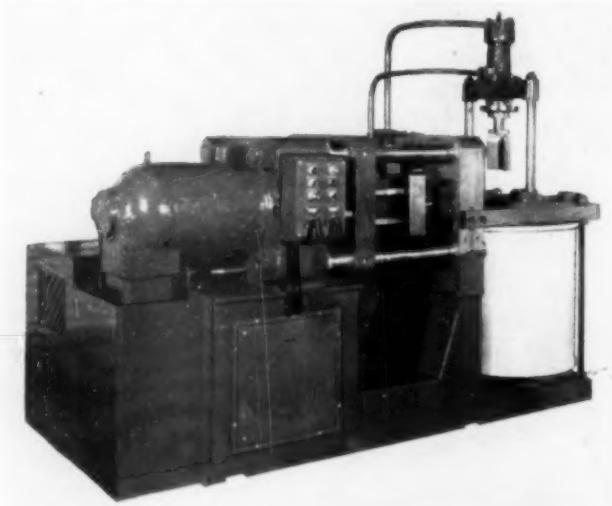


FIG. 5B.—At left: hot chamber Die Casting Machine by Hydraulic Press Manufacturing Company, Mt. Giledd, Ohio. FIG. C above, is a cross section of the H-P-M hot chamber machine. Note the melting pot and opening in cylinder, just over and under the piston. Metal is forced, by piston pressure, through the "gooseneck" and into the mold cavity.

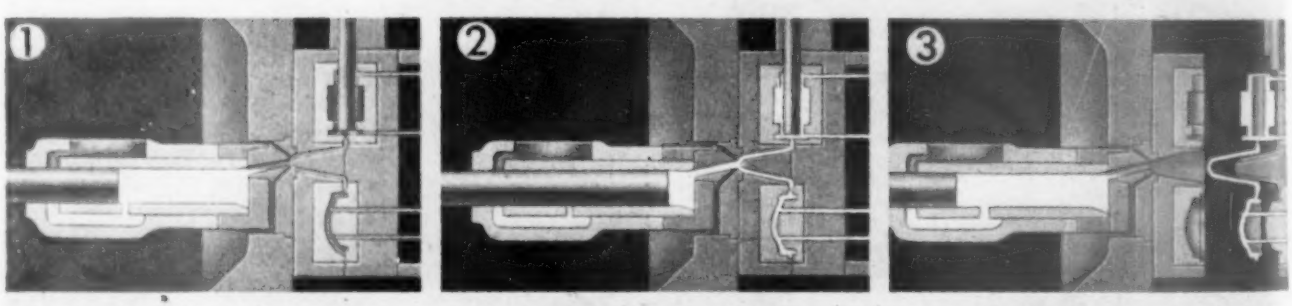


Pictured in Figs. 6A and 6B are modern, cold-chamber die-casting machines with hydraulically-operated injection mechanism which permits the use of maximum casting pressures. Molten metal is retained in a holding furnace adjacent to the machine and ladled into the injection chamber for each cycle of operation, during which movements of the injection piston may be controlled by means of a foot pedal. Function of the pedal is to open a valve, permitting hydraulic fluid to flow under the high pressure of a hydraulic pump and accumulator assembly so as to actuate the injection piston.

When the injection piston or ram has forced a predetermined quantity of hot metal into a die cavity, the movable platen can be moved away from the stationary platen almost immediately—either with a time-control mechanism or by hand-operating a control lever for the

FIG. 5D below.

HOT CHAMBER OPERATING CYCLE



1. Injection cylinder assembly fills with molten metal.

2. Ram injects molten metal into die cavity.

3. Core is pulled and casting ejected by manual or automatic means.

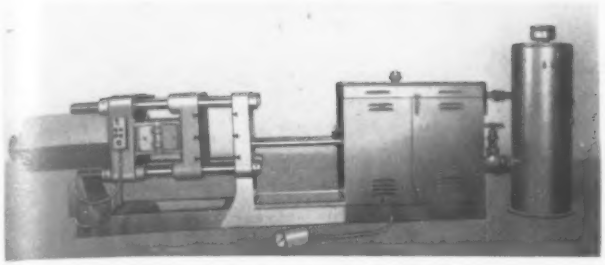
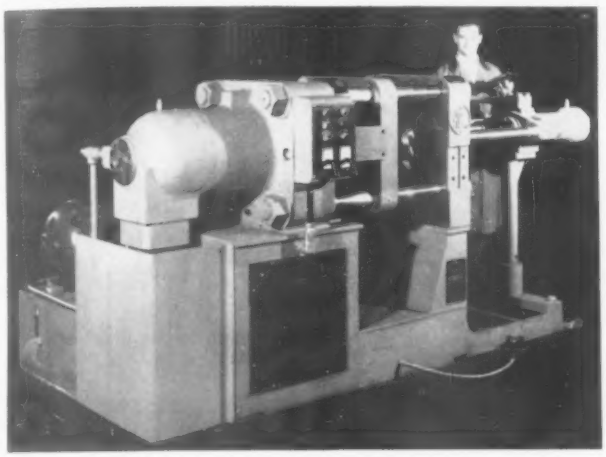


FIG. 6A, above, shows Model HD Harvill Die Casting Machine as "converted" to cold chamber operation. Conversion from hot to cold chamber—and vice versa—requires only about 0 minutes. Fig. 6B, below, the Model 150-A (150 ton) cold chamber Die Casting Machine by Hydraulic Press Manufacturing Company, Mt. Gilead, Ohio.



valve for the die-moving cylinder. Tie bars align the movable platen, and the precision adjustment of dies on the platens is permitted by the use of die-adjusting nuts.

As a rule, hot-chamber machines are used to die-cast alloys, such as lead, tin and zinc, which melt at the lower temperatures (400 to 800° F.) while cold-chamber machines are used to die-cast alloys with melting points as high as 1700° F. Typical alloy specifications are shown on following pages.

The efficient use of modern die-casting alloys and machines primarily depends on the ability of the individual Tool Engineer to produce a practical design for the mold or die needed to manufacture a given article. Parts of the average casting die, as shown in Fig. 7, might be listed as (A) stationary die half, (B) die leader pin, (C) leader pin bushing, (D) die cavity, (E) metal passage, (F) core recess, (G) metal passage plug, (H) movable or ejector die half, (I) core-pull mounting bracket, (J) core-pull rack, (K) core-pull pinion, (L) ejector or knock-out pins, (M) surface pins, (N) ejector plate, (O) ejector racks, (P) ejector pinion, and (Q) ejector box.

FIG. 6C below; FIG. 7 at right.

Sometimes called the "hot half" because it is adjacent to the injection nozzle on a die-casting machine, the stationary die half is mounted on a stationary platen by means of bolts and must remain in a single position while it is in use.

Operating Principle Described

In cold-chamber die casting, hot metal is injected into the die cavity by way of the runner and gate in the stationary die half. Then, when the metal has solidified, the injection piston may continue its forward stroke so as to eject the cast from the stationary half as the movable die half is pulled away, causing the cast to cling to the movable half. Therefore, the injection piston is the only "ejection mechanism" ordinarily provided in the stationary die half.

Leader pins maintain the alignment of the die halves. These are hardened and ground alloy-steel rods which should be inserted in the matching die halves at the beginning of die construction in order to maintain the relationship of the halves from start to finish, and when the dies are mounted on a casting machine the leader pins should operate freely without evidence of stress in their bushings.

The die cavity is an impression machined into the die blocks or into separate pieces of steel which are mounted in pockets in the die blocks. Bored into the stationary die half, and counterbored on the face matching the stationary die platen of the machine which will be utilized, is the metal passage. Ordinarily, this hole is in the center of the die, but it may be off-center when the size or shape of the die would otherwise cause tie bars or other machine parts to become die-mounting obstructions.

Actually, the core recess is a cylindrical cavity in both die halves, its purpose being to accommodate a core which is round to the point where it meets the die cavity proper—whence the end of the core may be any shape or size required by the nature of the impression to be made in the part.

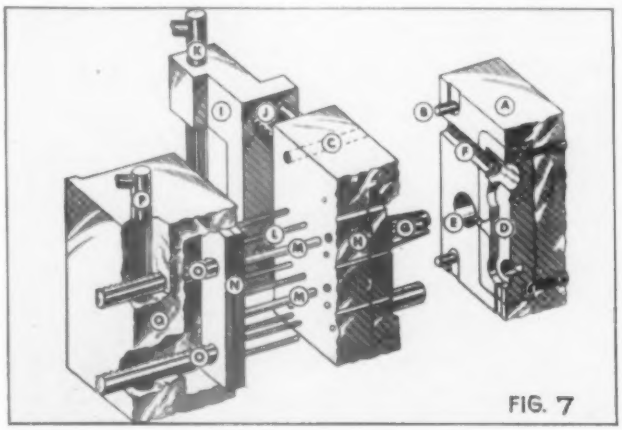
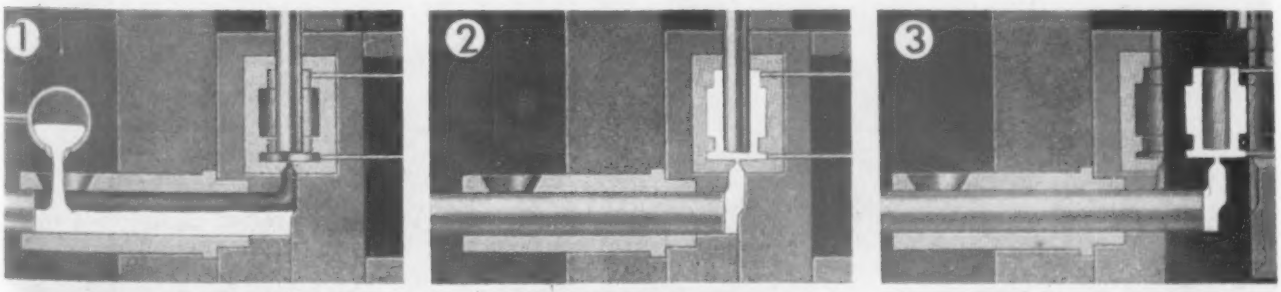


FIG. 7

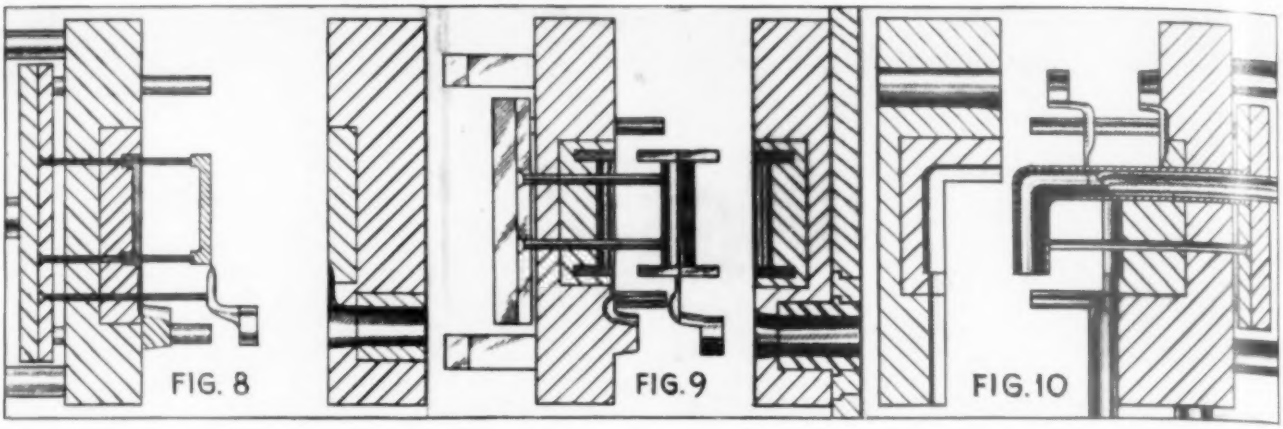
COLD CHAMBER OPERATING CYCLE



1. Metal is ladled from holding furnace to injection cylinder.

2. Ram injects molten metal into die cavity.

3. Core is pulled and casting ejected by manual or automatic means.



Extending into the metal passage is a metal-passage plug in the stationary die half, and its design usually includes a channel runner for the flow of molten metal into the die cavity.

The movable or ejector die half is that portion of the die that should contain the mechanical means of pulling cores, and operating knock-out pins. Knock-out or ejector pins free finished casts which normally cling to the movable die half when it is pulled to the open position.

Serving as a carrier for cores, is the core-pin mounting bracket. This may be moved into the cavity before each operating cycle and removed from the solidified casting before the casting is ejected from the die. Cores may be directly attached to this bracket, and it is generally considered good practice to mount the bracket in a position that will be normal with relation to the die block face although, in this connection, it is often practical to pull a core at an angle. The core-pull rack and the core-pull pinion are mechanical means of actuating the core-pull mounting bracket, and they may be powered either manually or hydraulically.

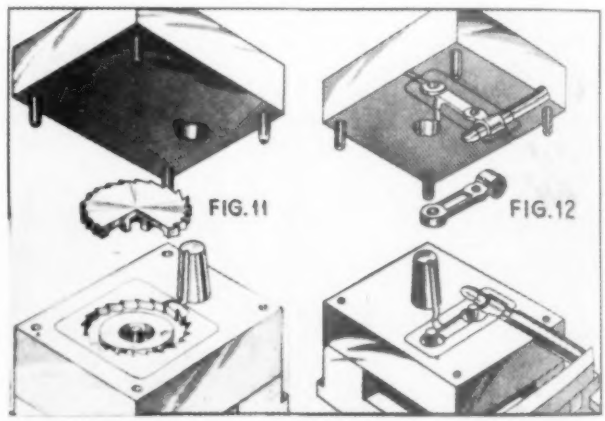
The Function of Ejector Pins

Knock-out or ejector pins may be either flush or retracted slightly into the surfaces of the movable die half when the die is closed. Surface pins are often used to keep the ejector pins flush with the cavity surfaces, and an ejector plate should be placed so that all ejector pins will move forward simultaneously with even pressure when the movable die half is retracted. The number of ejector pins is determined by the size and nature of a specified cast.

Ejector racks and pinions are mechanisms used to move the ejector plate, and may be manually operated. The ejector box retains the ejector plate and provides a means of mounting the ejector rack and pinion assembly, being of sufficient depth to permit full extension of the ejector pins.

Fig. 8 shows what may be considered the simplest type of casting-die design, wherein the cavity is sunk in the ejector half only. Such a design is suitable for the production of a part which is flat on two surfaces with a bead around its outside diameter. The die halves are parted on one surface, and for this reason the hot half may be nothing more than a piece of flat steel.

Numerous casting dies are constructed with a portion of the die cavity in each of the separate die halves, and if uniform casts are to be made therein the cavities must be perfectly matched and set up so that their alignment can be constantly maintained. Figs. 9 and 10 show comparatively simple designs, in which cavities are respectively machined in two die halves. Complexity of the part may be increased



Typical Specification and physical properties of aluminum base materials.

ALUMINUM-BASE MATERIALS			CHEMICAL COMPOSITION											PHYSICAL PROPERTIES		
Spec. No.	Alcoa Class	No.	Al	Si	Fe	Cu	Zn	Mn	Mg	Ni	Sn	Ti	Other	Yield Min. P.S.I.	Tensile Min. P.S.I.	Elong. In 2" Min. %
AC-11347— Amend 1		13X	R	10.0 12.5	.80	.15	.10	.05	.05	.05	.05		.10	21.000	39.000	4.5
AN-QQ-A366 Amend 4		13	R	9.5 13.0	2.3	.60	.50	.30	.10	.50	.10		.20		33.000	1.5
AC-11347 Amend 1		356	R	6.5 7.5	.60	.20	.10	.10	.40				.20	18.500	35.000	6.0
46A141NT Amend 4	5	85	R	4.5 5.5	2.3	3.5 4.5	1.0	.30	.10	.50	.30		.20	19.000	32.000	2.7
QQ-A-591	11	85X	R	4.5 9.5	2.0	3.0 4.0	1.0	.50	.10	.50			.15	19.000	32.000	2.0

Note: All elements maximum except where range is specified.

COPPER-BASE ALLOYS	CHEMICAL COMPOSITION									PHYSICAL PROPERTIES		
Specifications	CU	ZN	SN	AL	MN	FE	PB	NI	IMP	Tensile P.S.I.	Yield P.S.I.	Elong. % In 2"
HARVILL No. 70	55.-60.	REM.	1.50	1.50	1.50	.4-2.	.40	.50	.80	60.000	25.000	10%
HARVILL No. 110	58.65	REM.	.30	5.	3.50	.4-3.	.40	.50	.80	80.000	55.000	8%
HARVILL No. 120	60.68	REM.	.30	7.	5.	.4-5.	.40	.50	.80	100.000	65.000	4%
A. S. T. M. B-176 42T—CLASS A	57.	30.	1.5	.25	.25	.25	1.50	Silicon .25	.5	45.000	25.000	10%
A. S. T. M. B-176 42T—CLASS B	63.-67.	REM.	.25	.15	.15	.15	.25	.75-1.25	.5	58.000	30.000	15%

All elements maximum except where a range is noted.

Typical Specification of copper-base alloys.

by the addition of stationary cores in either or both die halves, as well as by variations in parting lines. Fig. 10 indicates a die with an elbow fitting and an irregular or joggled parting line which permits use of one stationary core in place of two movable cores.

Fig. 11 shows another simple casting-die design, to which a cored hole has been added without greatly complicating the die-fabrication procedure. The core in this case is a stationary part which does not extend beyond the face of the movable die half, and the cavity could be made by machining around it (leaving the core pin standing as part of the die solid); or, if construction of the die were further simplified, the core pin could be fabricated separately and added to the machined cavity. Disadvantages of the latter practice may be listed as follows:

(1) Each cast would have a "witness mark" at the point where the core pin is mounted. (2) If the core pin should become loose, metal would flash between the core pin and die plate, making the ejection of casts difficult—if not impossible.

Stationary core pins must, of course, extend into the die cavity in a direction parallel to the motion of the die half—since otherwise casts could not be satisfactorily removed from the cavity.

Designing Ingenuity Necessary

Considerable ingenuity must be exhibited by the tool engineer in devising methods of die construction to overcome the need for movable cores, which will almost invariably retard a casting cycle, and in many cases it is a good idea to have a cast article or part redesigned if necessary to avoid such die units.

Indicated in Fig. 12 is a die set-up wherein a single movable core is operated in one direction normal to the parting line or plane of the die. Within the die cavity are two stationary cores which will also form holes in the article that is to be cast. The movable core is shown attached to its mounting bracket and partially removed. When metal is injected into the die, it is fully closed; then, as the dies are opened, the bracket is moved, drawing the core from a cast that has solidified in the cavity.

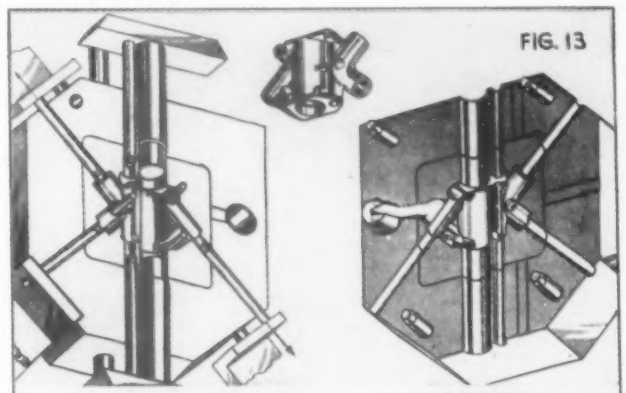


FIG. 13

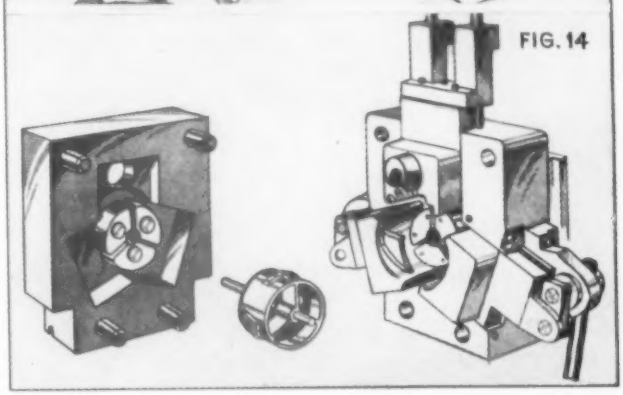


FIG. 14

The possibilities of intricate coring in die casting are well illustrated by the die and cast shown in Fig. 13. The cast has eight holes—three being made by stationary core pins in the ejector die half and five being made by movable cores, three of which are at an angle to the axis of the cast. It should be noted, here that the longitudinal hole through the cast is cored from two directions—a common practice when long holes are required or when the taper of core pins must be minimized. It is generally necessary to remove a

Typical Specification of zinc base alloys.

ZINC-BASE ALLOYS	CHEMICAL COMPOSITION								AVER. PHYSICAL & MECH. PROPERTIES			
Specification	AI	CU	MG	FE	PB	CD	SN	ZN	Tensil: Str. P.S.I.	Elong. In 2"-%	Brinell H'rdn's	Charpy Imp.
ASTMB86-43 Alloy XXI	3.5 4.5	2.5 3.5	.02 .10	.10	.007	.005	.005	R	44.000	2		6
ASTMB86-43 Alloy XXIII	3.5 4.3	.10	.03 .08	.10	.007	.005	.005	R	35.000	3		12
ASTMB86-43 Alloy XXV	3.5 4.3	.75 1.25	.03 .08	.10	.007	.005	.005	R	40.000	2		12

ALL ELEMENTS MAX. EXCEPT WHERE SPECIFIED AS A RANGE — NOTE: Pb + Cd + Sn Max. = .010

MAGNESIUM-BASE MATERIALS

Specification	MG Min.	Al	MN Min.	CU Max.	SI Max.	NI Max.	ZN Max.	Other Max.	CHEMICAL COMPOSITION / PHYSICAL PROPERTIES: Yield Str. P.S.I.	P.S.I. Tensile Str.	Elong. In 2"-%	Brinell H'rdness
Dow Metal R		9.0	.20				.60		Typical 20.000	Typical 33.000	3	44
Dow Metal EX.	R	5.8 7.2	.15 Max.		.1 .3			.5	17.000	27.000	4	

Typical Specification of magnesium base alloys.

thin sheet of metal from holes made with split cores, since it is almost impossible to tighten the cores so that no metal can flow beween them.

Fig. 14 shows the die set-up for casting a drum (center). Sliding die members are used, and their arrangement is such that they can be withdrawn from a cast before it is ejected. These slides are similar to cores, being moved into the die blocks prior to each injection of metal, although their function is to form the entire outside diameter of each cast. As a rule, dies with slides are expensive, being employed only when other production tools cannot be utilized.

Loose die pieces are sometimes required to cast articles with unusual designs, but should be avoided whenever possible because they can delay production even more than will sliding die members. Fig. 15 shows a loose piece of knock-out die arrangement in which the loose piece is ejected with a cast, from which it may be later removed in a special fixture, in order to form undercuts in two lugs on the cast article.

Multi-cavity casting dies should be designed whenever the size or shape of a cast article will permit their use, since they will greatly increase the productivity of a machine by making it possible to cast several articles simultaneously. Fig. 16 shows a multi-cavity die and a cast (lower center) which represents the simultaneous fabrication of six parts with different designs.

When it is most economical to fabricate single-cavity dies,

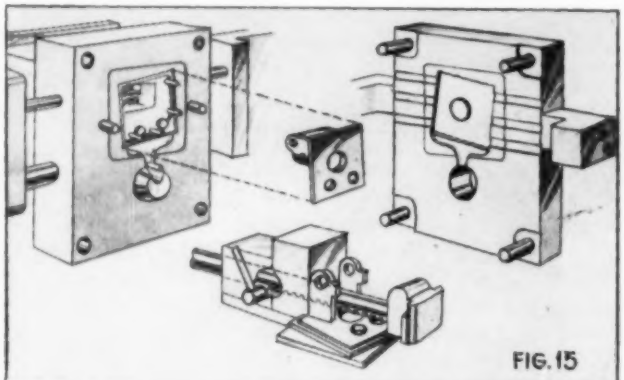


FIG. 15

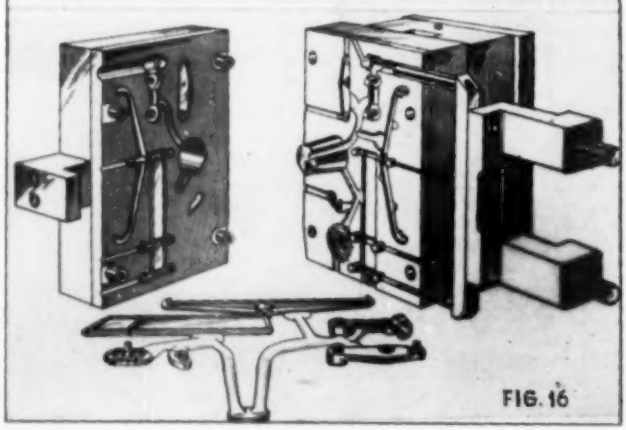


FIG. 16

it is sometimes possible to mount several dies of this type in a suitable frame, as indicated in Fig. 17, so that they will serve as a multi-cavity die. Frames for such work and related units can often be economically purchased from various sources as standard die parts.

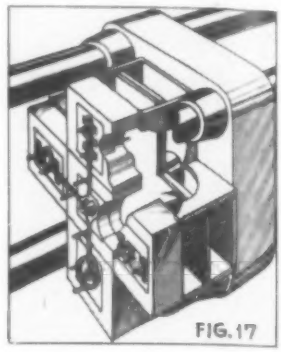


FIG. 17

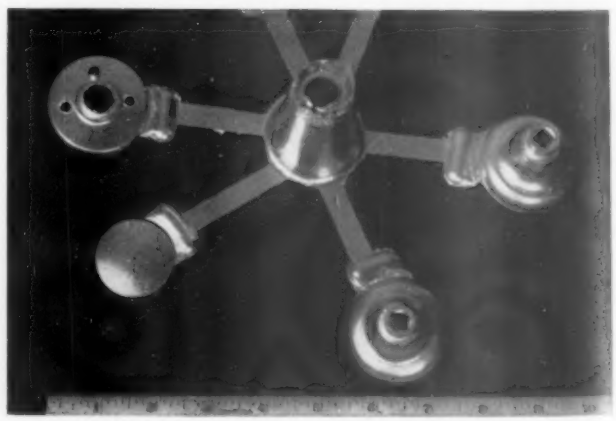
Most die castings must be machined or cleaned up by various machining operations after they are removed from the die casting machine, but hours of production time can frequently be saved if the tool engineer will first make certain that his die designs will not create unsightly or hard-to-remove flash or sprue defects in production.

An example of easy-to-finish die casting is shown in Fig. 18, a photograph of a "shot" with which doorknob and escutcheon casts have been made in a multi-cavity die. As the reader can see by glancing at the finished doorknob assembly in Fig. 19, nothing more than simple cutting and polishing operations were required to make the parts of the shot into finished articles.



Die casting is not a desirable substitute for forging and machining techniques when highly-stressed articles are required, since it results in a granular metal structure which is superior only to other types of casts. However, it is probably the only metals-fabrication technique that is comparable to plastic-molding processes from the standpoint of production economy.

FIG. 18, below, die casting "shot" of door knobs and escutcheous cast in multi-cavity die. At left (Fig. 19), the finished parts which only require removal of flash and polishing to put them in finished condition.



By James Walker

Drawing Die Problems and Formulae

A Comprehensive Treatise Covering Advanced Design and Construction Of Simple and Compound Drawing Dies for the Mass Production Industry

Installment No. 6 of a Series - - The Techniques of Drawing

A COMPOUND DIE IS A DIE that is capable of producing more than one operation with each stroke of the press. A compound die differs in construction from a progressive die inasmuch as all operations are completed in one stroke without progression. If the desired quantity is 5,000 or more and there are no double-action presses available, and the material thickness is under 0.093", an appropriate design is shown in Figs. 58 and 59. Fig. 58 shows the die in an open position; Fig. 59 shows the die at the bottom of the stroke. This type of die is mounted in a single-action press and performs the blank and cup operations.

The operation of the compound die is similar to the dies described in Figs. 52 and 53, and 54*, the only difference being the addition of the blanking operation. This type of die is a more expensive one than a single operation die; however, it eliminates one operation, one operator's time, one handling of the material, and the use of one press. It is especially adaptable for high-production runs and where only single-action presses are available. The extra cost of constructing a compound die would be absorbed in a very short time for quantities of 5,000 and more.

Triple-action Press

Fig. 60 illustrates a compound die which is mounted in a triple-action press. This type die is capable of performing the operations of blanking, cupping, and embossing. The die is shown completing the blanking operation. The upper member is the blanking punch and also the blank holder. The lower member is the blanking die and also the drawing die. The operation sequence is as follows: the blanking punch and blank holder move independently up and down on the outer slide of the press, and can be adjusted to blank the part and then hold the part.

The adjustment should be so governed that the travel of the blank holder should be stopped within 0.002" to 0.005" of the blank. In the event wrinkles should occur in the cup, lower the blank holder. As the cycle progresses, the drawing punch starts its descent on the inner slide (or the plunger), drawing the metal down through the die where it is contacted by the embossing insert which rises on a plunger and is finally "spanked-in", at the bottom of the stroke. As the press ascends, the cup is ejected at *X*, or by the addition of the positive ejecting fingers, shown in Fig. 56.

Double-action Press

The term "double-action" applies to the dies whose drawing punches and blank-holders move independently of each other. The mechanical operation is practically the same as the triple-action press previously discussed. The only difference between the two is that the latter lacks one extra action which is the lower plunger. The design shown in Fig. 61 illustrates a double-action blanking and cupping operation of the push-through type. Push-through type dies are capable of higher production than ejecting type dies because the cup falls through the bolster plate into a container and does not

*Installment No. 5 August 1947, THE TOOL ENGINEER

FIG. 58. Single-action press. Blank and cup in compound die. Die shown open.

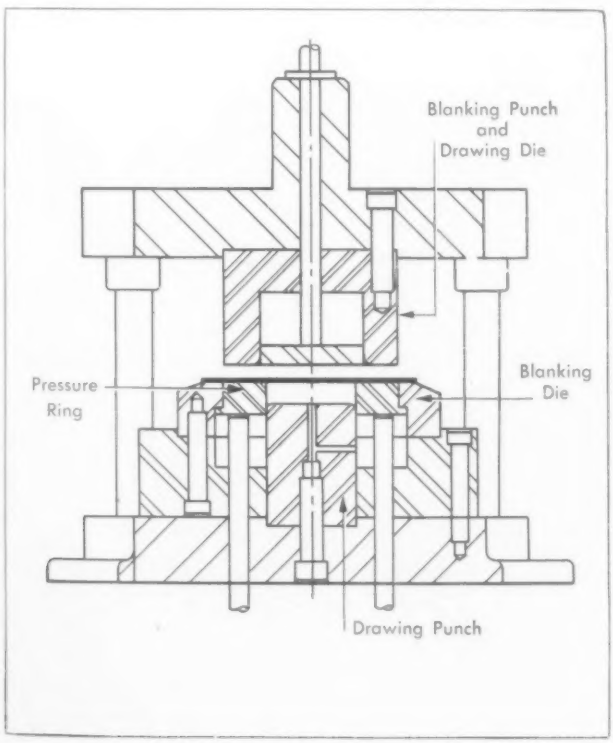
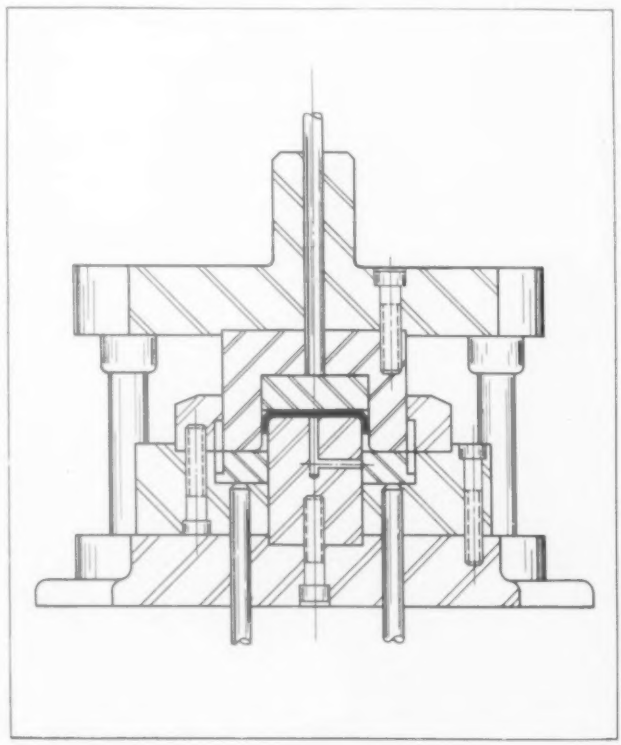


FIG. 59. Single-action press. Blank and cup in compound die. Die shown closed.



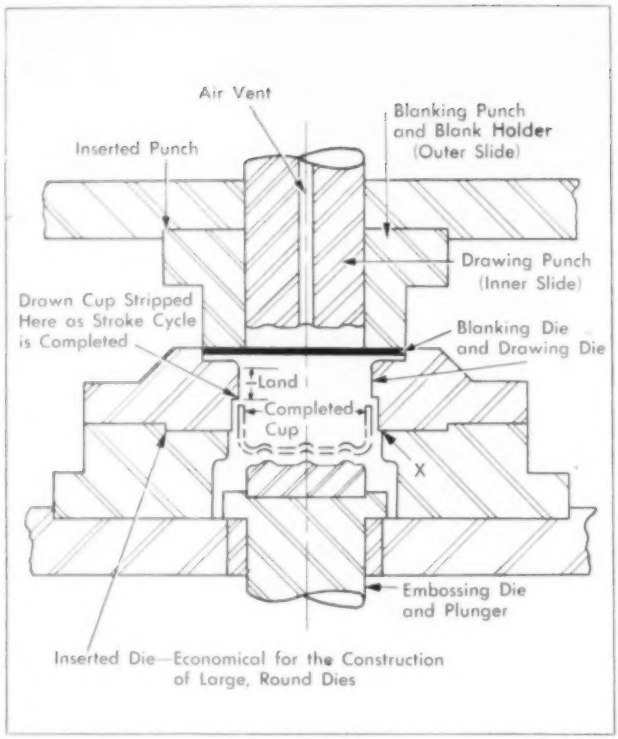


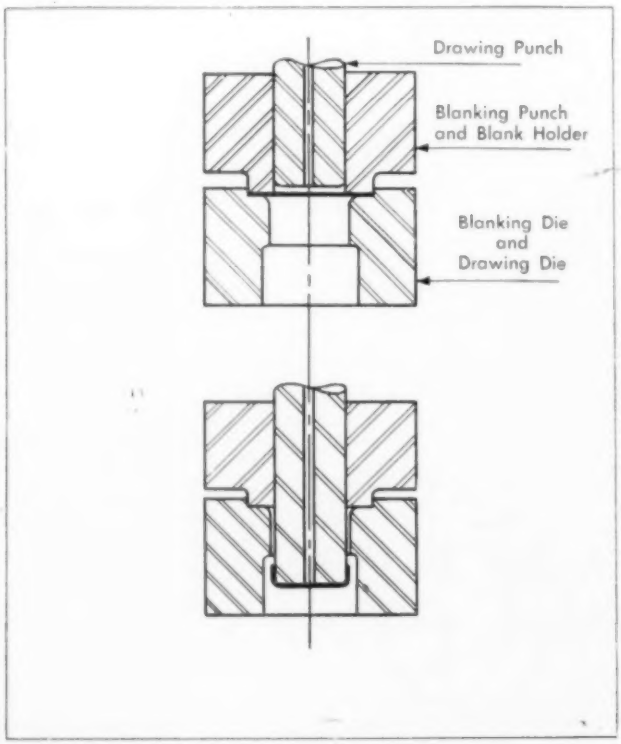
FIG. 60. Triple action; blank, cup and emboss.

have to be handled. *Note:* The design of the double-action die, illustrated in Fig. 61, is adaptable for materials 0.093" and under.

A typical large cupping operation is shown in Fig. 62. The blank holder, punch and die are clearly shown. In operation, the blank holder descends on the outer slide and clamps the blank; then the punch descends on the inner slide and completes the operation.

Drawing dies that are mounted in double-action presses make possible the drawing of a deeper shape than a compound die mounted in a single-action press. Because the

FIG. 61. Double action; blank and cup. (Push-through type.)



blank is first firmly clamped between the die and the blank holder, the completed cycle of operation is then performed without any change whatsoever of pressure to the blank holder. In cases where a compound die is used in a single action press, the blank is clamped between the die face and the pressure ring; and, as the press descends, a slight build-up of pressure increases as the press travels downward.

A more uneven drawn shape is obtained by this type of cushion than by a toggle drawing press. However, there are cushions available now that do not increase in pressure with the descent of the press. Also, these cushions can be obtained with a locking device that locks the cushion at the bottom of the stroke, and is released when the cycle of operation is almost completed. The self-locking cushion is particularly advantageous when drawing thin materials; hence the stripping is done without any opposing force to the drawn cup after the die has ascended.

Burrs

A blanking operation is usually the first stage of a series and is so simple an operation that it is very seldom given sufficient consideration, and in many instances failures incurred later on can be attributed to dull edges of the dies or to dies that have excessive clearances. Burrs that remain on the blanked parts are usually caused by incorrect clearances of the blanking dies or by tools that are in poor condition.

When these burred parts go unnoticed and are fed to the dies, obviously the pressure ring will be prevented from exerting its full degree of holding power. See Fig. 63. Then, as the punch descends, the blank will be forced between the punch and die with the burred edge dragging across the pressure ring and the faces of the draw die, in time, causing scratches to occur upon either of these members.

As the blank is forced between the punch and die, the burred portion tends to thicken most at the edges of the drawn shape, thus causing work-hardening. When work-hardening occurs at the edges of the cup, it will naturally tend to tear in the cupping operation or operations to follow. It is evident that the continued dragging of the burred edges finally "galls" the faces of either the pressure ring or the die face, resulting in "scored" parts, another factor to which ruptures are attributed.

FIG. 62. Drawing an aluminum alloy shell in a double-action toggle press. Blank holder on outer slide, punch holder actuated on inner slide. Photo by courtesy of Aluminum Company of America.



The greater percentage of blanks produced by blanking dies will have a slightly burred edge. Therefore, always nest the blank so that the burred edge of the blank will form around the punch. Even an excellently constructed die will produce a blank with one edge sharper than the other. The sharper edge is the one that faces the blanking die; the other edge is comparatively smooth. Hence, always nest the blank so that the sharper of the two edges forms around the punch. This procedure prolongs the life of the die and lessens the chance of galling.

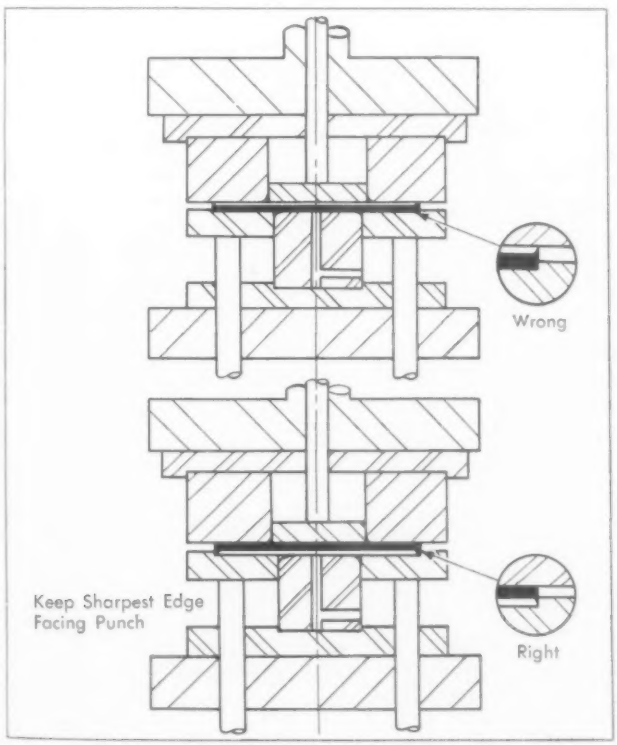
Radii

The following are a few helpful hints to remember when confronted with *rupturing*, *wrinkling* and *buckling*. For square and rectangular draws, decrease the drawing die radius (drawing edge must not be confused with corner radius) 12% at the corners—i.e., if the end and side radius of the drawing edge is 0.250″, make the radius in the corner 0.250″ minus 12%, or 0.220″. However, use care to have the varying radii blend smoothly into each other. Since the metal thickens at the corners, decreasing the corner radii helps move the metal slightly towards the ends and the sides.

A method that helps obtain a greater depth of draw, for cylindrical shapes, is to taper the pressure ring slightly, decreasing in thickness from the center outward to the edge. For example, if the pressure ring measures 2″ thick at the ID, then taper its face about 0.002″, decreasing towards the OD and following the exact procedure for the face of the die which matches the pressure ring.

Another method for obtaining a greater depth of draw is to rough up the drawing radius of the punch, or to step the punch slightly above the radius. In other words, chuck the punch in a lathe and take a sharp pointed tool and cut about four shallow grooves about .005″ deep around the punch radius. Or, decrease the punch diameter .005″ from the punch radius up to about ½″. This will leave a slight shoulder which "bites" into the metal and tends to bring the metal with it. The above suggestions should only be applied relative to over-reduction, which is partially responsible for ruptures.

FIG. 63. Nesting of blank so that burred edge will form around punch.



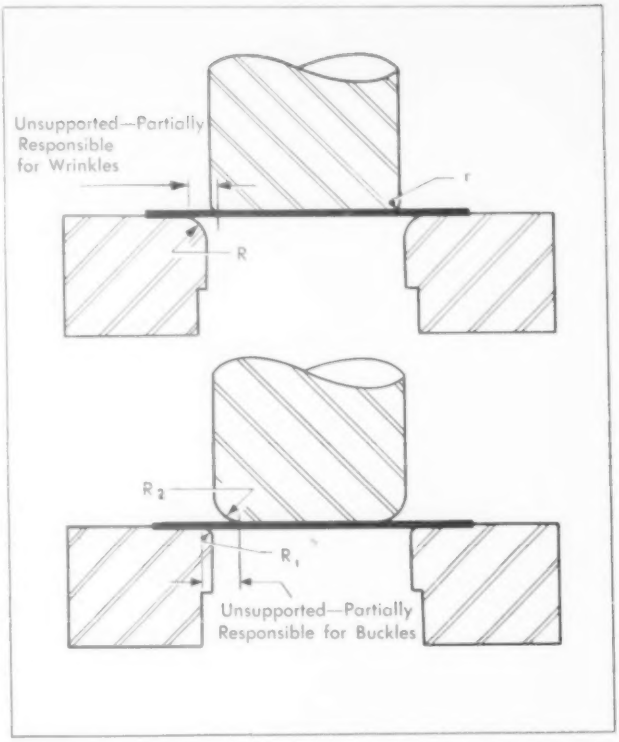


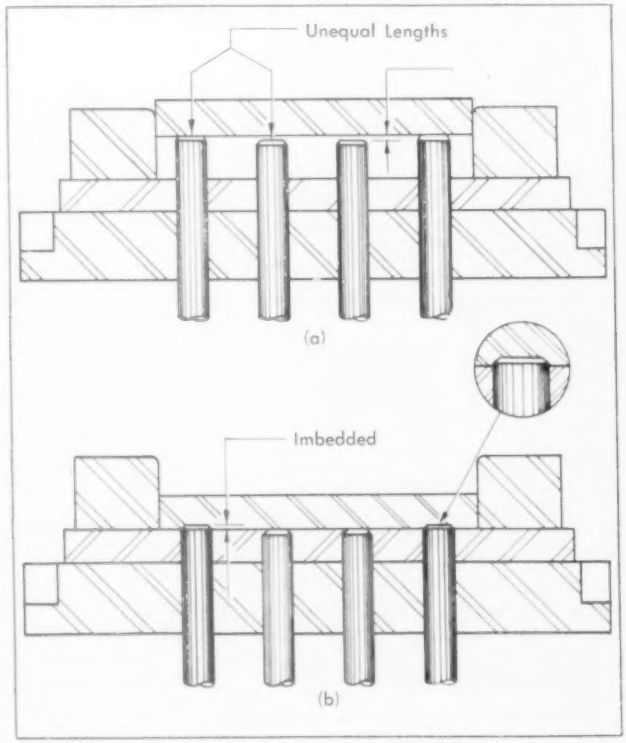
FIG. 64. Excessive radius on punch or draw die may cause buckling.

Wrinkling and Buckling

The terms "wrinkling" and "buckling" are often confused and, to define each: wrinkling is a wavy formation of the metal that has not yet reached the radius of the die; buckling is a formation of wrinkles that has already passed over the radius of the die. In other words, buckling is a formation of wrinkles which occurs in the body of a shell, and wrinkles are a wavy formation which occur in the flange of a shell.

Insufficient pressure of a pressure ring can be responsible for wrinkles; however, excessive pressure may cause the

FIG. 65. Unequal lengths of pressure pins are responsible for cocked or warped pressure ring.



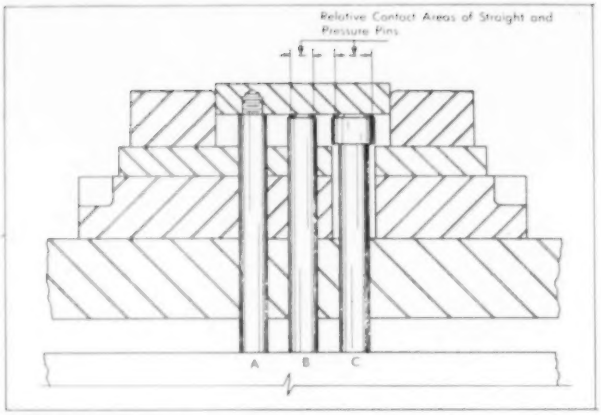


FIG. 66. Three types of pressure pins.

drawn shape to rupture. Also, excessive radius on the draw die will encourage wrinkles (see Fig. 64 at R), and too sharp a radius (see R_1) will tend to prevent easy flow of the metal.

Excessive radius on the punch (See Fig. 64 at R_2) is partially responsible for buckling. It is important, then, that a compromise be made between the two. When wrinkling occurs, exert more pressure to the pressure ring, decrease the die radius and increase the radius of the punch. When buckling occurs, decrease the radius on the punch and increase the radius of the die. Buckling, because the metal is unsupported for too great an area, will occur more frequently in tapered, conical, and hemispherical shells.

Pressure Rings

A pressure ring is just as important as any of the components that make up a die. Pressure rings are undoubtedly the "most taken for granted" component of the punch and die assembly. Too often, a well designed and well constructed die fails because of a poorly constructed pressure ring.

It is important to harden at least the drawing area (the area taken up by the blank perimeter) of a pressure ring for production runs that exceed 200 parts. The drawing area should also be polished to a mirror finish in order to partially provide "slipperiness" for the blank. To help produce an even drawn part, the pressure ring should be surface ground so that its faces are parallel.

It is also important to harden that portion of the pressure ring that contacts the pressure pins, as the constant impact of the pressure pins on a soft surface will finally leave their imprints, as shown in the insert in Fig. 65, or cause the pressure ring to bend. A pressure ring that is warped is partially responsible for ruptured or uneven drawn shapes, more so in nonsymmetrical and rectangular shaped parts.

Another important fact to consider, when designing pressure rings, is that the pressure ring should be of sturdy construction; that is to say, it should be constructed from $\frac{3}{4}$" steel for rings up to 6" x 6"; $1\frac{1}{4}$" thick for rings up to 12" x 12"; $1\frac{3}{4}$" thick for rings up to 18" x 18"; $2\frac{1}{4}$" thick for rings up to 24" x 24", or an additional $\frac{1}{2}$" thickness should be added for every 6" in width.

Pressure Pins

Pressure pins are often regarded as "just another pin", and frequently their unequal lengths, such as illustrated in Fig. 65 (a) and (b), are responsible for warped or cocked pressure ring. The pressure pins should also be hardened and ground to equal lengths, and when high production is required, it is better to use the type shown at *C* in Fig. 66, because the larger the area at the end of the pin which contacts the pressure ring, the less chance there is of an imprint to that surface. Also, the large head pressure pin cannot drop through the holes of a bolster plate as sometimes happens to the smaller diameter pins.

Bolster Plates

The following suggestions are intended for those who would like to standardize their present press equipment, or standardize new equipment which would be adaptable to their present equipment.

The bolster plate layout, as shown in Fig. 67, is designed so that the majority of the presses in the plant will be adaptable to most of the dies constructed. That is to say, it is not practical to have one bolster plate hole layout spaced 2" apart, and another bolster plate layout spaced at $2\frac{1}{2}$". For an example, let us suppose that there are four drawings or forming dies to be run, and there are only four presses available that are capable of handling the dies.

Two of the dies are so laid out that they can be run in only two of the presses, that have a bolster plate layout spacing of 3", which corresponds with the die layout; however, the presses intended for the dies are in use at this time. The other two presses have a bolster plate layout spacing of $2\frac{1}{2}$"; consequently, the latter two dies will have to be set aside until the presses with a coordinating bolster plate layout are available. This condition arises in many shops, particularly when press tonnages vary greatly.

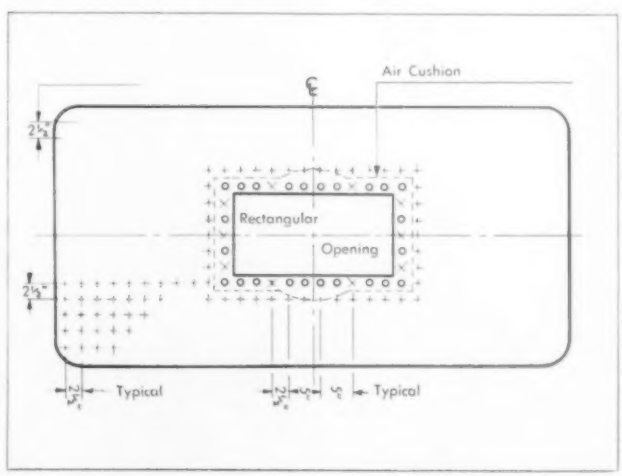
In some cases the standardization of all presses is not possible; however, the majority can be standardized. It would be well worth the time and expense, for some of the plants, to renew most of the press bolster plates with a standard hole layout and to equip each press with a new all steel bolster plate.

To simplify press setup and save design costs and tool room costs, the designs of the bolster plates shown in Figs. 67 and 68 are presented for their worth. Note the layout of the bolster plate shown in Fig. 67; however, disregard the rectangular cutout for a moment. When a die is designed, the relation of the center line of the punch shank and the center line of the bolster plate layout must be considered.

The proposed rectangular cutout eliminates the relationship of the bolster plate layout and the punch shank, because the pressure plate assembly, of the die, can be placed through the bolster plate opening on top of the air cushion (see Fig. 69) without regard to the hole pattern of the bolster plate. Obviously, the size of the die that can be so mounted is limited; nevertheless, a good portion of the dies can be constructed in this fashion.

The rectangular opening also provides a convenient means for removing the slugs that accumulate on top of the air cushion during piercing operations. It is also evident that the rated tonnage of the press, the thickness of the bolster plate, and the number of holes in the bolster plate govern the size rectangle that can be sawed out. If the area of the rectangular opening is too small to receive the die, the die could

FIG. 67. Bolster plate with rectangular cutout.



be set up in a larger press which would have a greater area cutout in the bolster plate, because of its greater thickness.

In cases where the perimeter of the pressure pads would exceed the largest rectangular opening, naturally the relationship of the bolster plate layout and the punch shank must be considered. If the dies are too large for the largest of the single-point presses, or if the dies require a higher rated tonnage than the single-point presses are capable of exerting, then the layout as shown in Fig. 68, is worth considering.

Fig. 68 is a proposed design of a bolster plate layout that could be adapted to presses having twin or triple air cushions. *Note:* the same chordal layout is carried out here as in the case of the single-point press, which would permit mounting three dies simultaneously in the event the single-point presses were bearing most of the production load. Also worthy of note is the access to the tapped holes at 5″ intervals, which facilitates setup.

The slide should be laid out and tapped at 5″ intervals. The chosen layout pattern of both the bolster plate and the slide should be presented with the order of any new press equipment, and the thickness of the bolster plate *should be determined by the press manufacturer.*

Mounting

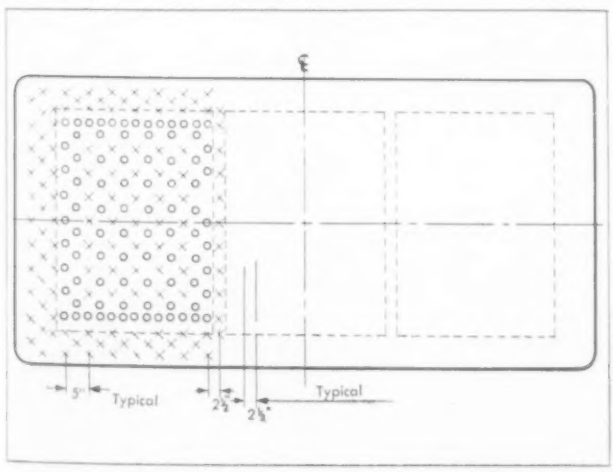
The following suggestions are offered to facilitate mounting punches and dies to their respective die sets. It is economical to provide sub-plates for all types of dies. That is to say, a punch and die should be mounted to a sub-plate, then mounted to a die set. Then, when a punch and die become obsolete, the tapped holes that were used to align the punch and die can be transferred from the die set to a new die. The only additional holes needed would be new dowel holes.

Insert the punch and die to their respective sub-plates (see Fig. 69), especially when high production is demanded. The inserted method should be applied particularly for cylindrical dies, because the operation can be done very easily in an engine lathe. When, however, (as previously stated) high production is demanded, the punches and dies should be inserted whether the die is round or irregular.

The procedure for mounting a round die is as follows: First, heat-treat the punch and die before mounting; second, grind the OD of both the punch and the die. Measure the OD of the punch and die accurately and counterbore their respective sub-plates 0.001″ to 0.003″ larger than the OD of the punch and die. This type of construction eliminates the need for doweling, as the only movement of the tools would be in a circular direction; hence, it would be impossible for the punch and die to get out of alignment.

Third, mount the punch and die to their respective sub-plates. *Important:* Do not drill and counterbore the top face

FIG. 68. Bolster plate adaptable to presses with twin or triple air cushions.



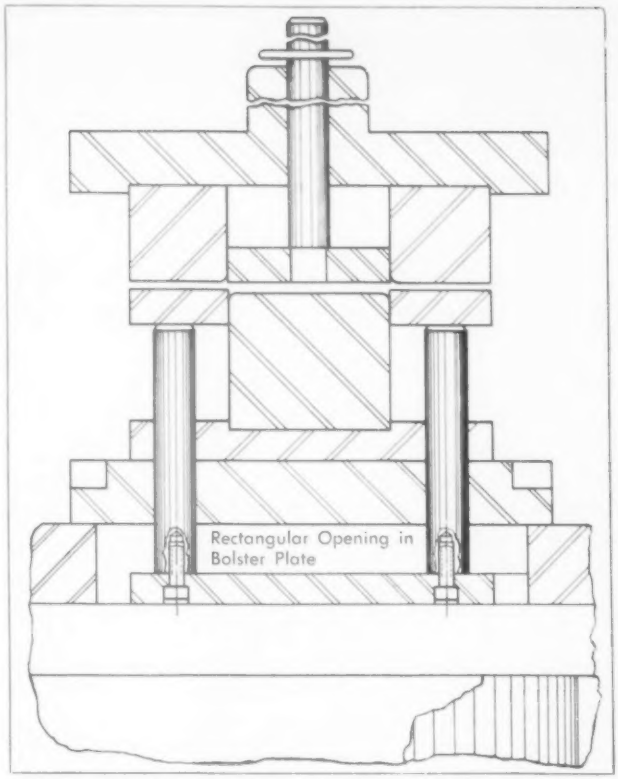


FIG. 69. Mounting of punch and die, using bolster plate with rectangular cutout.

of the drawing die as it will mark the blanks and hinder the blank from slipping easily between the pressure ring and the die face. Instead, always drill and tap blind holes in the under side of the punch and die. Fourth, bolt the punch and die to their sub-plates. Fifth, for inverted draw dies—that is, draw dies whose pressure rings are operated by air cushions, rubber, or springs from beneath the die—bolt and dowel the punch and sub-plate assembly to the lower die set.

Sixth, cut segments of material thickness about 2″ long and bend the segments 90 degrees. Place the segments (about 6 or more depending on the size of the die) around the perimeter of the punch, as shown in Fig. 70. Seventh, place the die down over the shimmed punch and bottom the die subplate on a pair of ground parallels. Eighth, assemble the punch holder to the die set and clamp the die set together with two heavy-duty "C" clamps. Ninth, drill, tap, and secure the die sub-plate to the punch holder. *Do not complete the doweling operation at this time.*

Tenth, after the die is bolted to the punch holder, back off the cap screws one turn. Assemble the pressure ring and set up the die in a press for a trial run. Turn on the air pressure and place the blank in the nest provided. Start the motor of the press and draw a cup. Stop the motor, drop the air cushion, and inch the press to the bottom of the stroke, but, *do not remove the cup.* Remove the die set. Eleventh, tighten all cap screws that secure the die and its sub-plate to the punch holder.

It is always good practice to use a drawn shape, rather than shim stock, for spacing the clearance of the punch and die before the final doweling is performed, because drawn metal acts different than strip shim stock, especially in non-symmetrical shapes whose contours have both stretch and shrink walls.

The procedure relative to mounting just described pertains to all types of dies. In other words, no matter what type of die is to be mounted, always mount the lower member first. This can be done without any interference whatsoever by the upper member. After the lower member is secured by cap screws and dowels, shim the two members together. The

upper member can be bolted to the punch holder very conveniently. Many die makers make the mistake of bolting the upper member first, then shimming the lower member. The lower member must then be held by clamps and the die set taken apart in order to drill and ream the lower member; hence a slight shift of either member might result.

Calculations of Press Tonnages

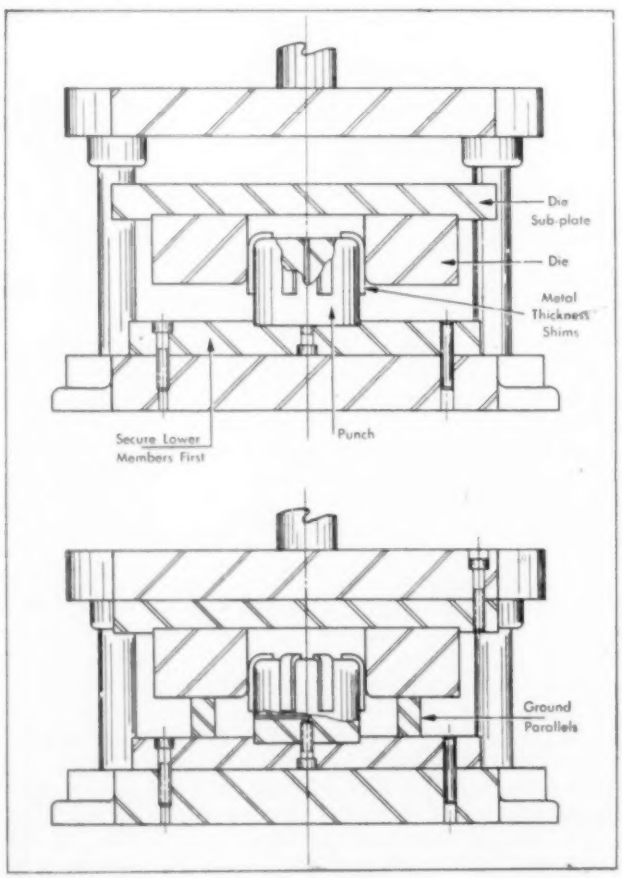
Overloading the press can be responsible for a broken crank shaft or a press frame, and until one has had considerable experience with a variety of operations of various metals, thicknesses and shapes, he should always make certain a press is of the required capacity to produce the article in question.

An important consideration, in regard to continuous operations, is that when a press is performing the operations of blank and cup, there is a decided amount of energy used up at the impact loads. The motor must restore enough energy before the next cycle; therefore, it must be borne in mind that all continuous operations (operations without idle time) require more tonnage than one cycle operations. When in doubt, check with the press manufacturer.

The greatest majority of the blanking dies should be "*sheared*", as shown in Fig. 71, the exception being for thin materials 0.025" and under. However, dies that are required to blank lengthy perimeters of 0.018" high carbon steels, or stainless steels which have great shear strength, should also be sheared. Shear should never be machined on a punch or die decreasing toward the center, but should be machined from center to edge decreasing in thickness toward the edge. Placing the shear in this manner prevents sudden shock to the edges of the tools, where chipping occurs first.

Shear reduces the cutting load and makes possible the use of a smaller press, also reduces the violent shock to frame and drive of a press that results when shear is ignored.

FIG. 70. Procedure for mounting.



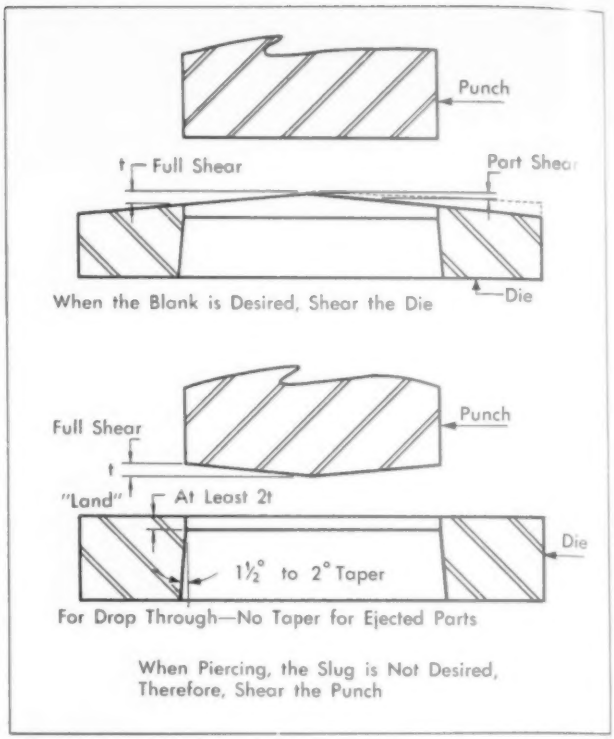


FIG. 71. Shearing of blanking dies.

Shear is considered in two ways: part-shear and full-shear. Part-shear is machined on tools for relatively thick materials (¼" thickness and up). Full-shear is not practical for heavier gages because the "land" of the blanking die would be exceeded. Full-shear reduces the tonnage load about 50%; part-shear reduces the tonnage about 25%.

To calculate the tonnage required to blank an article, proceed as follows. Multiply the thickness of the stock by the shearing strength of the material (not the tensile strength), by the total perimeter inches. For example, to blank a disc 5" diameter of 0.040" mild steel (50,000 lbs. shear strength), multiply 5" + 3.1416 + 0.040" ± 50,000 lbs., which equals approximately 15½ tons.

Calculations for drawing are similar; however, greater tonnage is necessary because the tensile strength of the material is considered, and this exceeds the shear strength. An additional factor, which also increases the tonnage, is the blank holding pressure. Therefore to draw a cup of 0.040" material × 5" diameter × 1.5" high, the calculation would be as follows: the area of the side walls multiplied by the tensile strength times a factor which represents blank holding pressure, and an allowance for the position up from the bottom of the stroke.

Or, to site an example, 5" × 3.1416 × 1.5" equals approximately 18½ tons, and the blank holding pressure necessary would be about 6 tons, thus a press of approximately 25 tons would be necessary. However, the two preceding examples are just a fraction of the calculations that arise daily in the tool engineering departments, and to simplify press calculations, as well as to eliminate resorting to handbooks, data and figures, a calculator of the type shown in Fig. 72 is recommended very highly.

The press calculator shown* was created by Mr. Len Crary, a graduate of Stevens Institute of Technology who, since 1926, has been associated with the E. W. Bliss Co. as a staff engineer. The calculator is constructed of heavy vinylite plastic with a clear sheet of vinylite over printed

*The Crary press calculator was described in the Tools of Today department, page 76, February '47 THE TOOL ENGINEER. While ordinarily retailing at $15.00, Mr. Walker announces that the inventor—Mr. Len Crary—offers the calculator to A.S.T.E. members at 15% discount.

...ces, measures 9½″ square ... is comprised of a series of ... each containing a scale of ...surements essential in press ...ulations.

The scales were laid out by ...ffel and Esser Co., of Hoboken, N. J., internationally known makers of precision slide rules and drafting instruments. The calculator, which is fitted in a black leather case, is accompanied by a well illustrated 70-page manual, which explains the simple operation and conveys other valuable non-technical information.

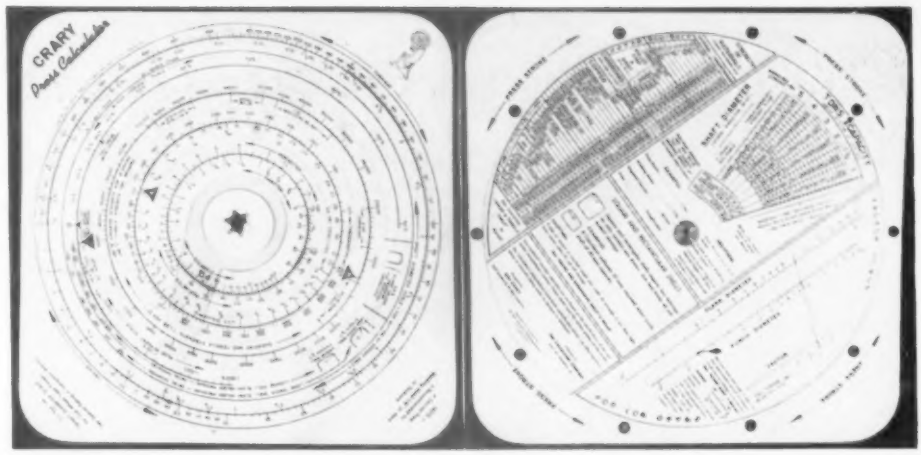


FIG. 72. The Crary Press Calculator, available from the Calculator Company, Teaneck, N. J.

A few examples of the calculator's functions are as follows: Find tons pressure required to blank out a 6″ diameter blank, 0.050″ mild steel, with an allowance for "full-shear". The answer—16 tons—is obtained simply by moving 3 dials. Example: 1/16″ thick half hard brass to be blanked and pierced by a compound die with full shear. The part has a 32″ perimeter, with a 2″ diameter hole pierced in the center. Calculations can be worked very easily in 30 seconds, the answer being 37 tons—or 29½ tons if the 32″ perimeter is completely cut through before the pierce punch engages the metal. Example: To draw a cup 5″ diameter × 2½″ height, 0.040″ soft (drawing) brass and of average blank holding pressure. The answer is 19 tons.

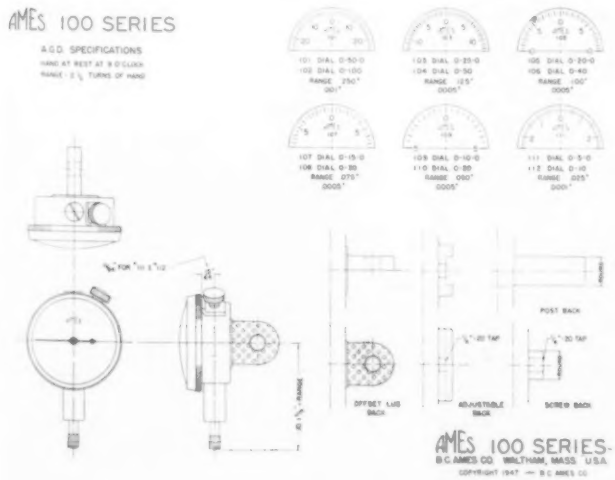
Also computed with ease are the tonnages required for blank holding pressure, working stroke, combination cut and draw dies in single-action presses, factor scale for low draws, flanged shells, square and rectangular shells, drawing in flywheel presses, oval shells, large (bottom corner) radius shells, heavy gage shells, dies operated in twin drive presses, toggle drawing presses, toggle press cut and draw dies, hemispherical shells, conical shells, redrawing operations, drawing speed, continuous operations, end wheel type presses, and blanking thick material.

End of part 6, this series. Installment No. 7 will follow in November *The Tool Engineer*.

Indicator Drafting Templets for Fixture Designs

TOOL DESIGNERS, draftsmen and tracers, required to show dial indicators on fixture drawings, will find their task speeded by the use of accurate, full-scale Indicator Drafting Templets developed by the B. C. Ames Co., Waltham 54, Mass. The templets, as per sample illustrated, are black-on-white line drawings, printed on both sides of durable bristol card stock which has a protective varnish-finish. Each set consists of two sheets, 8½ x 11″, punched for hanging up when not in use.

The three views of all four sizes of AMES Dial indicators are laid out, as are the following details: Six dial graduations for each size (eliminating the necessity for dividing off the dial markings); four popular backs (center and offset lugs, adjustable post, and screw type); and the five most-used types of contact points. Necessary dimensions are also shown.



In use, the templet with the desired drawing is slipped under the sheet (drafting paper, vellum, or tracing cloth) being worked upon and the indicator and its details quickly traced without resorting to the use of a scale or dividers.

The Indicator Drafting Templets, which are made up according to American Gage Design (A.G.D.) Committee Specifications are available from B. C. Ames Company on request.

New Uses For Galvalloy

GALVALLOY IS FINDING many new uses. It is now possible to tin magnesium with Galvalloy, using pure zinc as a filler or soldering agent. Molten zinc can be poured against the Galvalloy'd surface of the magnesium, producing a permanent bond. Ordinary solder or pot metal may be used instead of zinc but zinc or pot metal are recommended when greater strength is required. Galvalloy has also been successfully used on aluminum.

Another new use discovered for Galvalloy is the repair of corroded areas in Degreasing Tanks. Galvalloy very satisfactorily withstands the corrosive action of the vapors. The repairs can be quickly made with the use of a welding torch and wire brush. This eliminates lengthy down-time which would be necessitated by re-dipping or galvanizing the tank. Galvalloy is marketed by Metalloy Products Company, 1351 E. 17th St., Los Angeles 54.

By A. E. Rylander

Greater Production with Brown & Sharpe Automatics

LONG KNOWN FOR THEIR consistent performance, sustained high output and long and trouble-free life, the popular Automatic Screw Machines by Brown & Sharpe Manufacturing Company, Providence, R. I., have been redesigned to cover an even greater range of operations and to meet conditions created by the widely varying materials of the day.

The line, which includes the B & S Nos. OOG and OG Automatic Screw and Automatic Cutting-off Machines (High Speed), as well as the larger No. 2G—with 1" or 1½" capacity spindle—have each been redesigned for increased efficiency and include the following features:

The spindle, which is of unit construction and easily removed, is positively driven at all speeds by multiple-width roller chains from the speed and ratio gears in the base. The spindle driving chains which, with the rest of the driving mechanism, are completely enclosed, have predetermined tension adjustment for maximum chain life. Thus, tension remains unchanged for all combinations of speed and direction of spindle rotation.

Compact and without weighty mechanism, the spindle is mounted in precision, anti-friction bearings at both front and rear, the box for the latter containing a preloaded bearing that provides for both end thrust and lift. The sprockets, in turn, have hardened steel bushings and turn on precision roller bearings.

Spindle speeds, in 196 two-speed combinations, are provided in sixteen groups, each of which has a high speed with which any one of the twelve low speeds can be used in combination. Approximate ratios, high to low, range from 1.6 : 1 to 13 : 1 except for the highest and lowest high speeds, where ratios range from 1.6 : 1 to 11 : 1. High and low speeds can be forward and backward, both in same direction or in opposite directions. The exception is the ten combinations giving the highest total RPM, which can be used only in the one direction.

The unusually wide range of ratios permits selection of the correct speed for any operation within the capacity of the machines. Thus, one may select the correct speed for tapping or threading without in any way limiting the speeds for forming, drilling, or turning; also, there is available the right cutting speed for materials ranging from tough alloy steels to free cutting non-ferrous materials and plastics.

Changes in high speed and ratio are each made by changing one pair of pick-off gears, from a set of 16, in respective compartments in the base. The set gives all the changes of speed and ratio. Direction of low speed, relative to high speed, is changed by moving a ratio change gear from one center to another, while direction of high speed is controlled by a manual, built-in reversing switch. Provision is also made to reduce the speed of the driving shaft, when so desired, so that additional feeding length may be had. This reduction permits increasing the production time, per piece, for one cycle, a condition that may be found desirable at times.

An interesting feature of these machines is that, when the number of operations required to produce a part permits, cams may be so designed, and trip dogs so set, that more than one piece may be produced per machine cycle. Thereby, there is available the most efficient production rate for any work within the capacity of the machine to produce.

Production time is further enhanced because idle machine movements—such as feeding stock, changing speed, and indexing—are performed at a constant rapid rate (actually, in a fraction of a second) entirely independent of spindle speed or rate of production. Coordinated is the swing stop for stock which, entirely independent of the turret, is operated in conjunction with the feeding mechanism and therefore consumes no extra time. Thus, all six holes of the turret are available for operating tools, with further provision to use a single tool without indexing.

In line with nicety of engineering, the electrical controls —which conform to Machine Tool Electrical Standards—are built into the machine. Overload relays, with manual reset, are provided, and all controls are protected yet readily accessible. The combination magnetic starter and disconnect switch is mounted in a dustproof compartment in the rear of the machine. As a safety provision, turning the lever of the compartment door, prior to opening, shuts off the current.

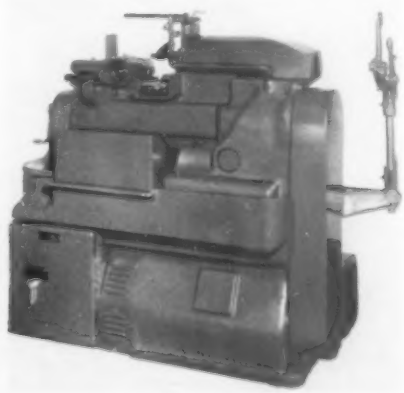
Other features, designed for safety and prolonged tool life, include automatic lubrication, a spring safety device in the stock feeding mechanism which prevents breakage in the possible event of interference with the advance of the feed tube, and a clutch that automatically disengages the drive to the camshaft should the tool slide be subjected to excessive strain. Further protection to the mechanism is afforded by the shock absorbing qualities of the leather driving belt.

Bar stock capacities of the Nos. OOG and OG machines are ⅜" and ⅝" throughfeeding fingers, respectively, and spindle speeds from 6050 to 50, and 4230 to 35, respectively. The Automatic Cutting-Off Machines are similar to the Automatic Screw Machines except for the use of a single-tool slide in place of the turret.





At left, the No. OG Automatic Screw Machine. At right, rear view of the No. OG. Below, detail view of the powerful, positive chain drive. Nos. OG and OOG machines are superficially alike in appearance.



By J. T. Lancaster

The Get-Together of Tool, Jig, and Fixture Design

Fresh thinking on the economics of Tooling, stressing versatility, so important in small lot production.

ON THIS PARTICULAR SUBJECT, it might be interesting to generalize a little. Standardization of design is difficult because of certain variable factors, particularly the approach to a new development which differs according to the individual plant policy. Despite many factors affecting design, certain fundamentals cannot be ignored. Set rules which are clearly explained are valuable as a guide to all concerned.

John T. Lancaster **is Chief Tool Designer with Richards-Wilcox, Ltd., London, Ontario. In addition to supervising tool, jig, and fixture design, his duties include purchase of new equipment, plant layout, production efficiency, and planning.**

Of the many books on the market showing the fundamentals of tool, jig, and fixture design and their applications, some are exceptionally well written. It would take volumes to illustrate the actual designs that are made possible through the application of these fundamentals. This article is intended merely to be a refresher and show only a few examples, which are actual applications; all others embody the same principles more or less.

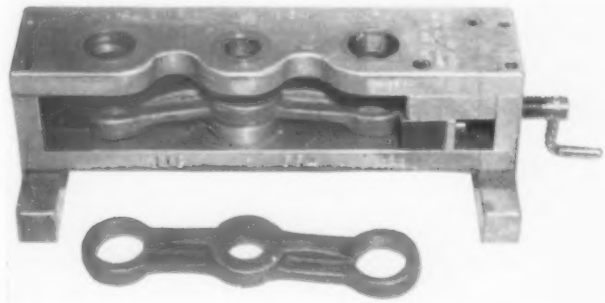


FIG. 2A. Photographic illustration of the jig sketched in Fig. 2, showing the quick-locating feature of V-blocks.

Engineering Economics

Too many companies are still apt to look on the development of tooling with impatience. They can be assured that rushing into a new project with more haste than thought rarely pays in the long run. Invariably, it is wishful thinking or ego-satisfaction that makes one turn his back on the cost of such a policy.

There are many cases of temporary tooling, where "soft" jigs and fixtures are hurriedly made and put into production. Regardless of the time element, they should be made from free-hand sketches drawn by a tool designer. These free-hand sketches are filed away for future use, and later when convenient or imperative they are used as starter in designing the permanent tooling.

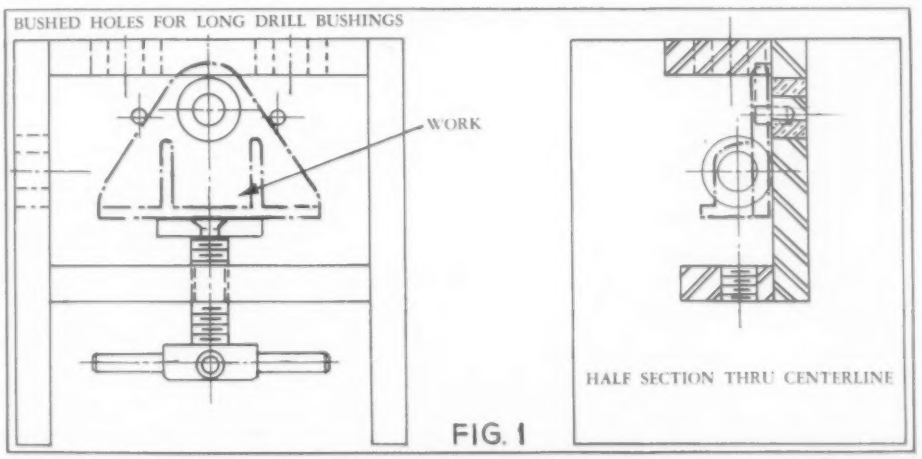
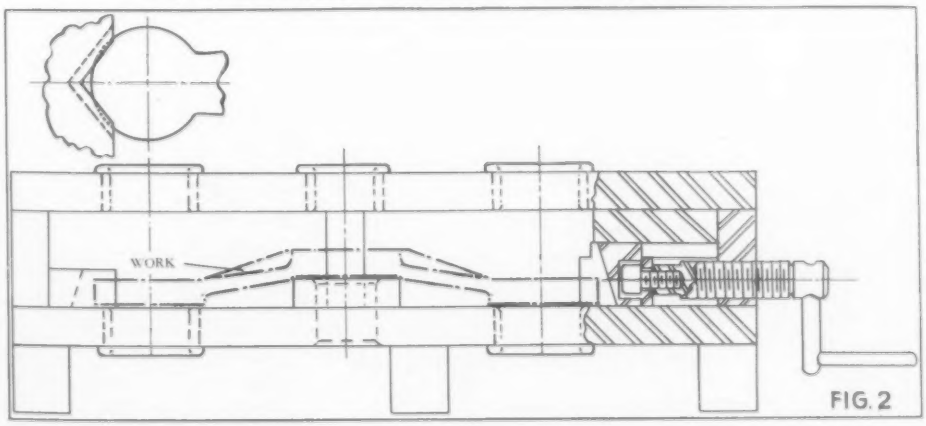


FIG. 1. A typical, simply-designed drill jig, feauring long drilled bushings which may be removed for tapping or countersinking. FIG. 2 below, a simple, screw-type jig.



Department Management

You cannot have several people in charge of a department. This is particularly true of any tool engineering department. One man should be given the responsibility, and he should answer solely to the management which must have confidence in his ability. In turn, the head of the tool engineering department should be generous in lending to others the benefit of his ingenuity and past experience.

He may call, at his discretion, a consultation of such people as are involved in the production of the parts for

which the tool, jig, or fixture is being designed. He might show his willingness to be sympathetic to the ideas of others, even to the extent of discarding his own if the suggested alternative has equal merits. It is a good practice to try to keep everyone content, but care must be taken that it does not create undesired precedents or red tape, or generally impede the function of the department. It is a moot point whether more is gained by bringing in the interested parties on the first design-planning conference, thereby assuring their later silence, or by actually designing, making, testing, and putting the item into production, and then waiting for criticism.

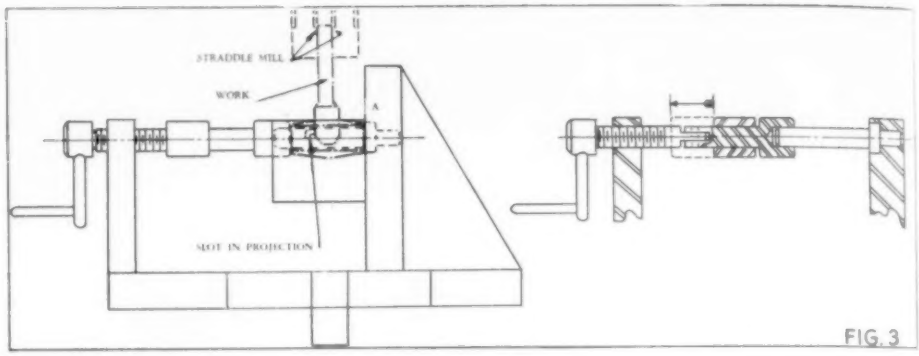
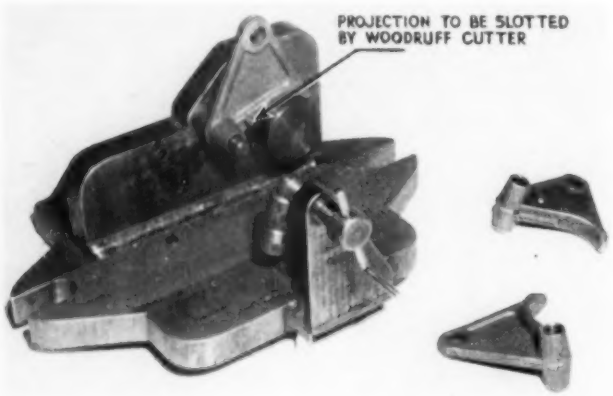


FIG. 3. A simple fixture for straddle milling and for slotting with Woodruff cutter.

No matter how thorough one acts in the preparatory stages by calling everyone in on the initial design, the designer would seem to have a one-track mind if, after the designed tooling had been operative for some time, he himself cannot see some small improvement to be made. Indeed, if he is progressive at all, he may feel that the whole construction is wrong.

FIG. 3A. Photographic illustration of the fixture sketched in Fig. 3, showing arrangement by which workpiece, after being straddle milled in position shown, may be turned on a swivel-post so that the projection is accessible for slotting with Woodruff cutter.



The Creative Urge

It is quite human for a designer of tools, jigs or fixtures to wish to design something without assistance or interference but, if the designers can be sold on the idea of collective reasoning, the experience of all concerned, rather than just one man, will be gained. On the other hand, it is very selfish to ask for ideas from a man just to prove he is wrong and adopt a supercilious attitude. In some plants, methods and amendment committees are a help. This is so only if the members are constructive rather than personal in their criticism. If you are head of the tool engineering department and have a group of men under you who are reasonable and cooperative, guard them jealously. If they are loyal, more is the reason to let them see that they have your wholehearted support.

Personal criticisms should not be tolerated; remember you are in charge, and therefore you must accept the responsibility for any shortcomings in the department. Never forget to congratulate your men on a good follow-through, and do not take everything they do for granted. Many of the men will tell you that they would rather accept criticism, but it is suggested that such an "open house" rarely works satisfactorily and many times lead to attempts at self-justification or subtle reshuffling of blame.

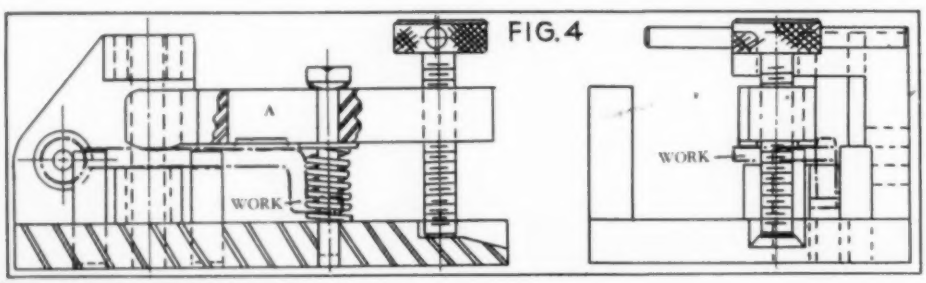
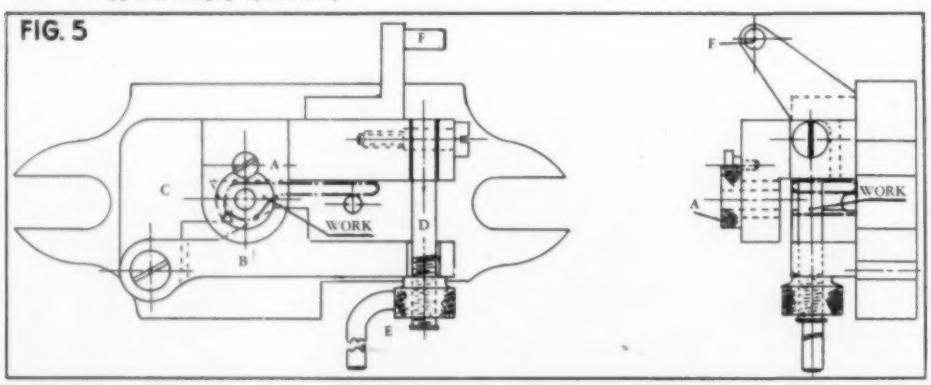


FIG. 4. A simple, screw-clamp type drill jig.
FIG. 5. Drill jig with swinging tapered clamp.



Processing the Request

Having received the authorized request for a tool, jig, or fixture, the tool design department takes due cognizance of the warrantable cost, the parts to be made (estimated or actual), operations, efficiency, and possible tool proving or development. The head of tool design obtains operation details, and if possible an actual sample, of the part for which the tool, jig, or fixture is to be made. He then picks out the engineer most familiar with the specific machines on which it is intended to perform the opreation. In this regard, the importance of designers having had actual shop experience cannot be stressed too highly.

The problem is then discussed and rough blocks (sketches) are made. The one that appears to be the most suit-

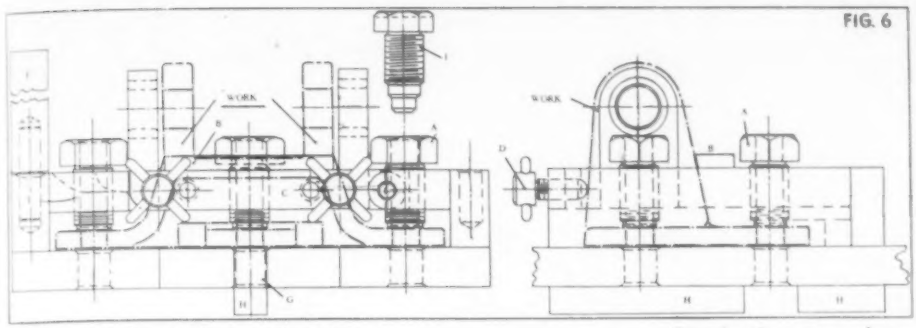


FIG. 6

FIG. 6. Combination drill jig and milling fixture.

able is selected. A three-dimensional drawing is now made, watching the principles of proportionate design, and taking into consideration the following factors: capabilities and efficiency of present equipment, chip clearance, weight of the proposed tool, jig, or fixture, safety, and handling time, e. i. putting work in, securing it, and taking it out after the machining is completed.

If coolants is to be used, see that its flow is not impeded by the proposed design. The designer should be sympathetic to the operator and see that the tool, jig, or fixture can be operated efficiently and safely when the operator's hands are wet and oily.

If the criticism of the other designers is invited, their diversified opinions may be extremely helpful, for very little will get by them. This mutual assistance helps prevent each from trying to outsmart another but does not eliminate the individual's natural desire to give a better presentation.

The department head where the tool is to be used is also asked to give his opinion, and any reasonable requests for charges are naturally acceded to. When everybody is agreed, the final drawing is made.

It is very important to record movement times of your various adaptations. The designs shown in the following examples give the normal handling times and not the actual operation time.

At all times, remember that your tool, jig, or fixture should be designed to make the manufacture of the part easier, better, quicker, safer, and cheaper.

Fundamentals Applied

The examples given in this article illustrate the simple application of design fundamentals. The drawings are schematic, but a few photographs are included to show that the tooling is not theoretical but was actually completed. Loading and unloading times given in the following paragraphs do not, of course, include the time for actual drilling or machining.

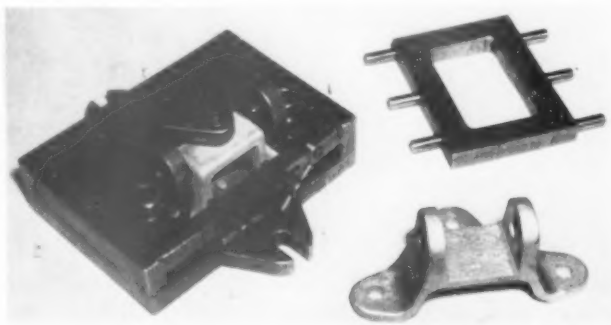
Fig. 1 shows a typical, simply-designed jig, used for drillinging 3/16" holes, one 1/4" hole, and one 5/32" hole to be tapped to 3/16". One of the 3/16" holes is counter sunk to take a flathead machine screw. This jig features long drilled bushings which not only line the drill up close to the work but also can be taken out for tapping or countersinking. A simple coarse thread screw is used for securing the work. Loading and unloading time: 7 seconds, total.

In Fig. 2 is shown a simple, screw-type jig which is used for drilling one 49/64" hole and two 1-1/16" holes. Features of this jig include two tapered V-blocks, one of which is stationary and the other movable by means of the simple screw shown. This screw has a small handle on the end which helps to speed up the job. When this screw is tightened, it holds the part firmly pressed between the V-blocks, as shown in Fig. 2 A. With head room between the work and the top of the jig, only half a turn of the handle is needed to release the work. Loading and unloading time: 8 seconds, total.

"Down-Cut" Holds Work

A simple fixture is illustrated in Fig. 3. This fixture features a swivel-screw which is held straight by means of a sliding collar. This tightens the work up sufficiently well against point "A" of fixture, and any other holding screws add unnecessarily to the handling time. It can be seen in the photograph, Fig. 3A, that the work is held against a post stop by the downward pressure of the cutter during the straddle milling operation. A fresh set-up

FIG. 6A. Combination jig and fixture of Fig. 6 shown with workpiece in place for drilling three 17/32" holes.



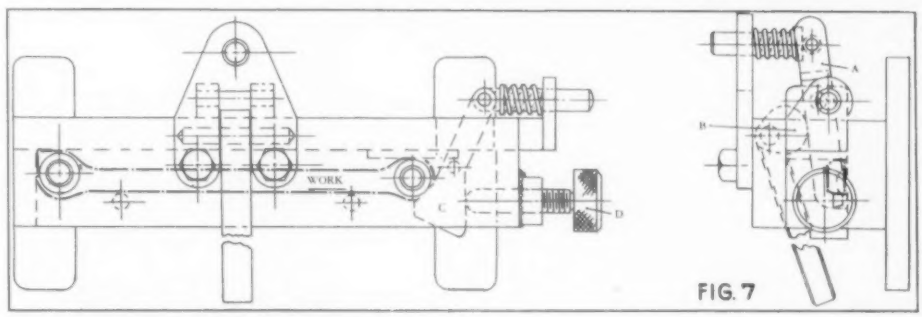
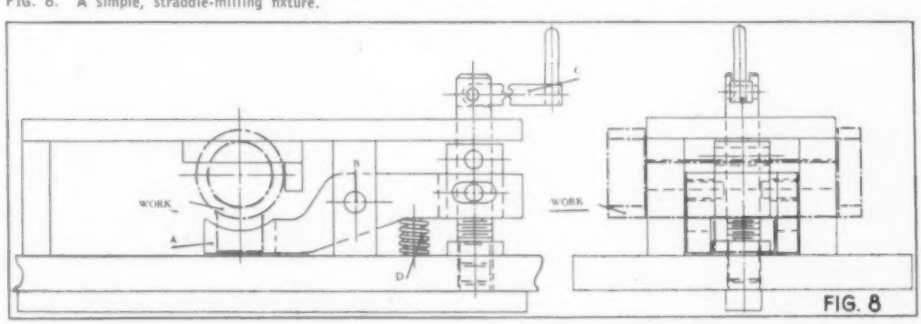


FIG. 7. Simple drill jig with work located by spring-loaded levers.
FIG. 8. A simple, straddle-milling fixture.



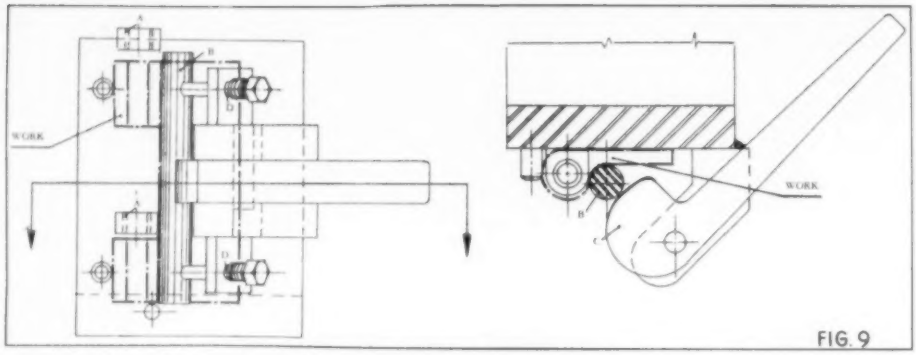
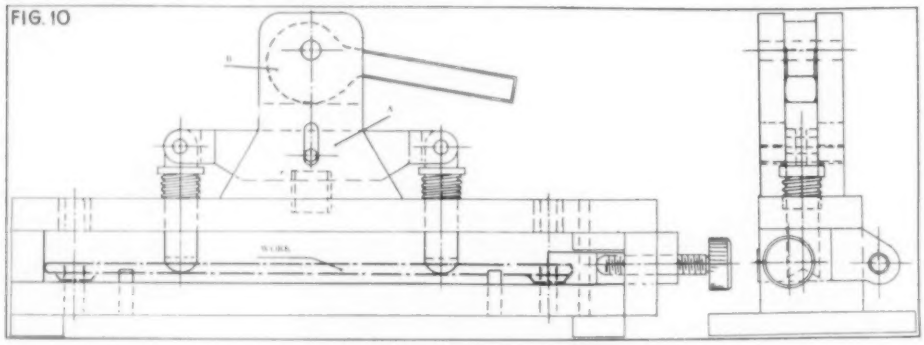


FIG. 9. Use of equalizing bar for holding workpiece while drilling two widely-separated holes in line. Fig. 10 below; drill jig with equalizing spring-loaded lever.



is used for putting a slot in the work projection indicated by arrow in Fig. 3A. The same fixture is used, with the work turned on the locating pin, and a Woodruff cutter used to make the slot. It takes 12 seconds to put in and take out the work for either of the two operations—straddle milling or slotting.

Shown in Fig. 4 is a simple, screw-clamp type drill jig, for drilling one 7/16″ hole and one 3/16″ hole. A slot is cut in the screw clamp arm "A", in order that the clamping arrangement can be drawn out of the way for loading or unloading the work. Loading and unloading time: 10 seconds, total.

Combination Fixtures

The drill jig in Fig. 5 has a swinging tapered clamp "B" which helps to locate the rounded part of the work against a cut-out block "C" which is also tapered, and which is stationary and fastened to the base of the jig. The screwlatch "D" having a nut and handle "E" locks the clamp "B" in position. The handle "E" needs only a 3/4 turn to release the latch, swinging it out of the way to rest on top "F". A drill bushing "A" is used for drilling the .257″ hole, and is then removed for tapping the hole to 5/16″. Loading and unloading time: 9 seconds, total.

A combination drill jig and milling fixture, Fig. 6, features piloted drill bushing hold-downs "A". To help line the work into position, it has a spring-loaded V-Block inside and to the back of the jig. It has hardened plate "B" up to which the work is pressed by means of two screws "D" set in a swinging clamp "C". Approximately 1½ turns on each hold-down "A" presses the work firmly against the base of the jig for the drilling of the three 17/32″ holes.

On each end of the jig are three holes "E" into which a special cut-out plate "F" is placed at either end when drilling one of the two ¾″ holes in the work piece (also see photo Fig. 6A). Approximately 48 seconds is required to locate the work and fasten in place, and a further 35 seconds for placing into position the cut-out plate "F". This does not include actual drilling time.

For milling of the work as indicated, the fixture is fastened down securely to the bed of the milling machine by two bolts using slots "G". The bars "H" line the fixture up squarely. The work is then placed into position and, using a ¾″ bar to line up the work, three screws "I" are screwed down rapidly, using a quick-acting screwdriver. Loading and unloading time, for milling operation: 48 seconds, total.

Quick Acting Fixtures

The drill jig in Fig. 7 is used for drilling one 3/8″ hole and one 5/16″ hole. A spring-loaded lever "A" presses down on the work by means of a quick-acting cam "B". Another spring-loaded lever "C" prevents any side play. One-half turn of the knurled screw "D" quickly locates the part and prevents any movement of work. This extra precaution only adds another 3 seconds to the locating time and the total time for locating takes approximately 8 seconds.

A simple fixture can be used for locating work shown in Fig. 8 for straddle milling. It features a simple spring-loading lever "A" pivoted at "B". Pressure is applied by means of handle "C". Three turns of handle quickly secures work in position. The handle "C" can be turned over and down out of the way when milling. Loading and unloading time: 12 seconds, total.

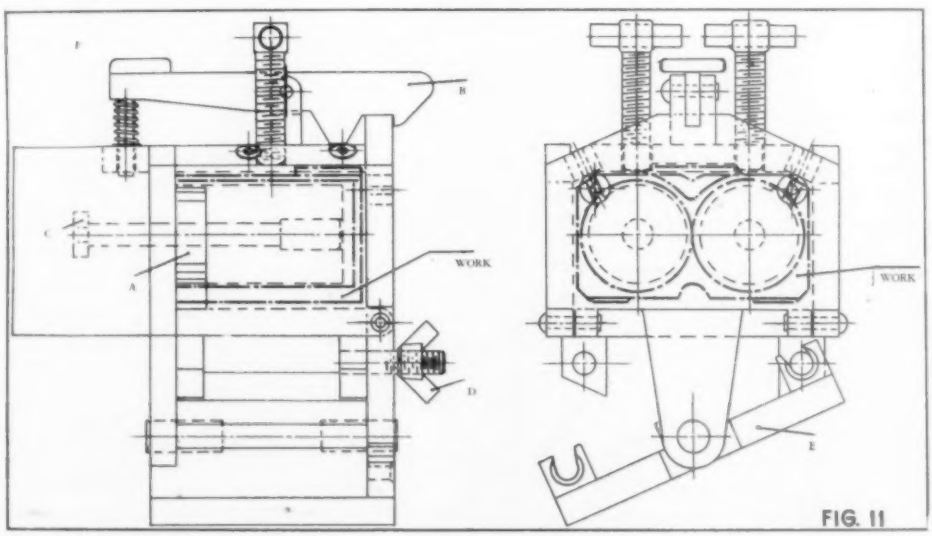
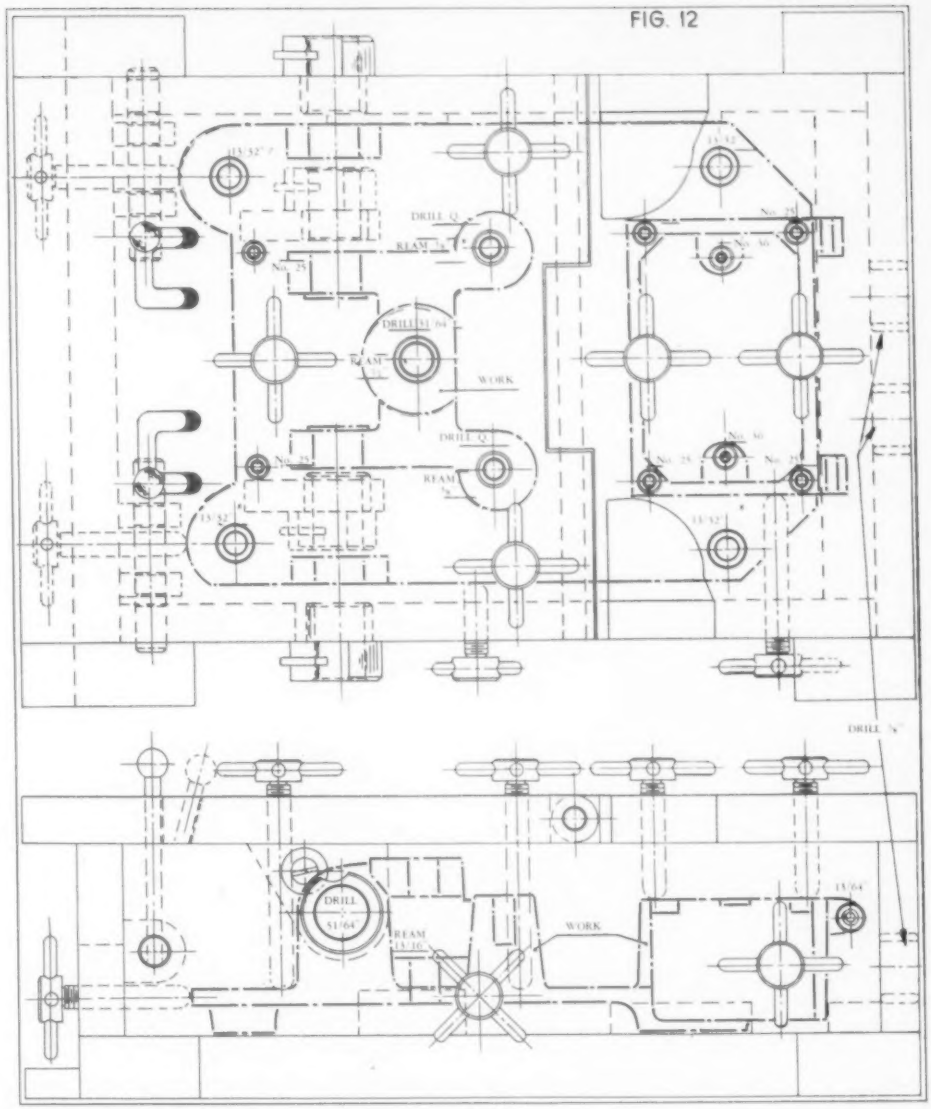


FIG. 11. Box-type drill jig. Changeable base permits drilling of four holes on angle.

FIG. 12. Typical box-type drill jig.



A simple drill jig, Fig. 9, is for drilling two 25/64″ holes through two pilot bushings "A". Pressure is applied to an equalizing bar "B" by means of a cam "C". Any little irregularity in the work is taken care of by the slack in the holes "D". Loading and unloading time: 10 seconds, total.

In Fig. 10 is a drill jig for drilling one 3/8″ and one 5/16″ hole. The main feature here is the equalizing springloaded lever "A" which takes care of any irregularity in the work. It is operated by means of a cam "B". Loading and unloading time: 9 seconds, total.

Fig. 11 is a box-type drill jig having cut-outs for chips "A". It is for drilling six .150″ holes. The lid is held securely in position by means of spring tension on latch "B". Depressing latch at "F" releases lid. There is a small attachment "C" which, when pressure is applied to it, lifts the part clear of the jig in order that the work may be pulled out by hand. Four of the holes have to be drilled on an angle, and for this purpose a base "E" is swung over to the desired position and locked by means of wing nuts "D". Loading and unloading time: 6 seconds, total.

A typical box-type drill jig of controversial design is shown in Fig. 12. It features a hinged lid, removable bushings, and large cut-outs for chip clearance (Fig. 12A). With this jig, 21 various-sized holes (see bushing sizes) are drilled, and some are counterbored and tapped. Quick-change chucks are used with designs of this nature. After machining, the work is to be assembled with gears, worm wheel, and worm. This necessitates keeping exact centre distances during the drilling operations. Sometimes, work of this nature may have multiple drill spindles or they may be spotted and drilled in sequence. Here again, the available equipment and quantity play a large part in design. Loading and unloading time: 70 seconds, total.

FIG. 12A. Photograph of fixture shown in Fig. 12.

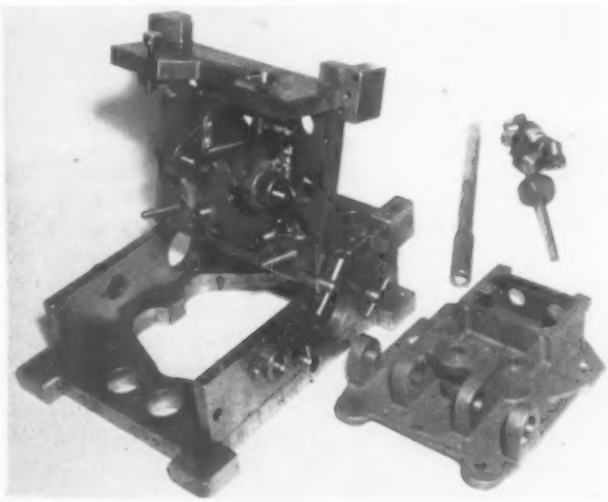


Fig. 13 illustrates a simple type of fixture for drilling, boring, and reaming work to 5/8″ at point "A". The work is also counterbored to 2-1/8″ x 1/8″ deep at point "B". The fixture has a tapered syindle to fit the headstock spindle of a lathe in which the operations are done. The work has two 13/32″ holes which were previously drilled in the base, and these are used for lining up the work at point "C" on the two pins "D". The work is held firmly pressed down by means of the two spring-loaded clamps "E". As a safety precaution, a bolt is put through "F" and securely tightened to the faceplate of the lathe.

Simple Lathe Fixture

The simple lathe fixture in Fig. 14 is for boring and reaming two holes to 1.626″. The rear is also undercut .015″ in the same fixture. It features an off-centre plate "A", on which a rectangular box "B" is fastened (Fig. 14A). This swivels on pivot "C" on the mounting plate "D". This mounting plate is fastened to the faceplate of

FIG. 13. Fixture for drill, boring, and reaming up to 5/8".

the lathe using bolts through holes "E". The off-centre plate rotates between stop "F" to bring work on centre for machining the two holes. Collared set screws "G" firmly fasten centre plate while in position. Blocks "H" also act as guides for the off-centre plate "A". Loading and unloading time, including relocation in centre plate: 65 seconds, total.

It is not claimed, by the writer, that the fixtures described are a "last word" in design. Neither are they mass production tools such as are used where vast quantities of parts are processed, day and day out. For example, the fixture shown in Fig. 3, which is designed to perform two distinct operations, would not be used for such mass production; rather, two fixtures would be designed, each suited to its particular function. And two machines would be required.

It must be considered, however, that all manufacture is not on a mass production basis, and that the tooling for small lot production often requires more forethought than is needed in cases where quantities are so great that the cost of tooling is a secondary consideration. In such cases, the greater cost of automatically operated tools is entirely warranted.

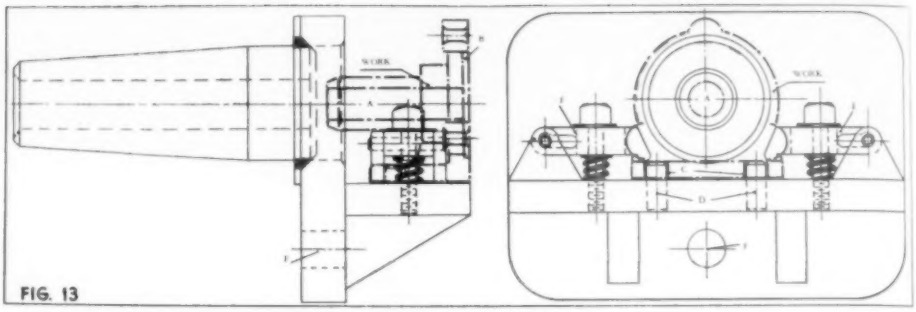


FIG. 13

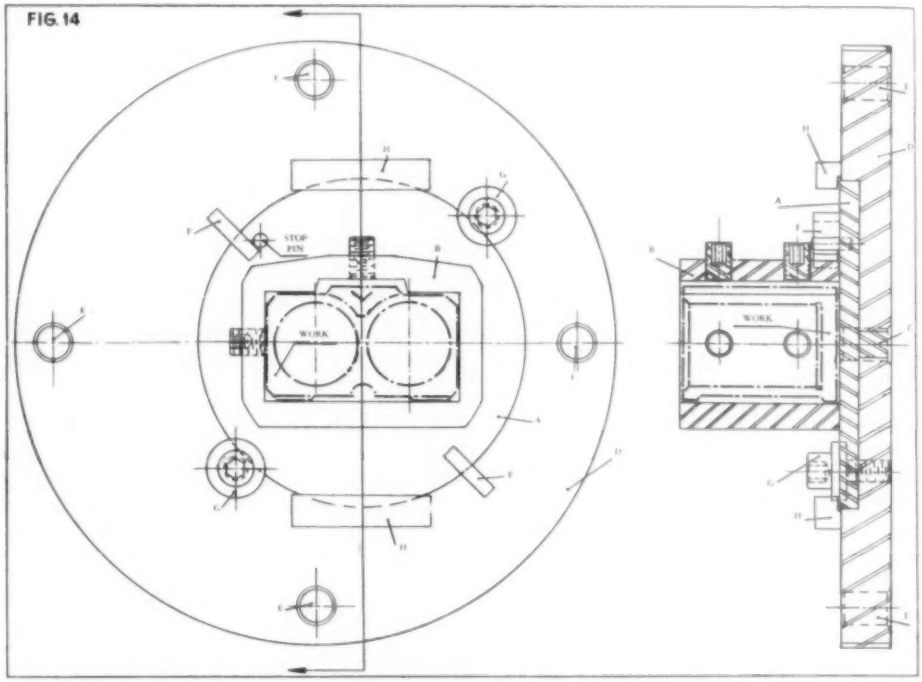
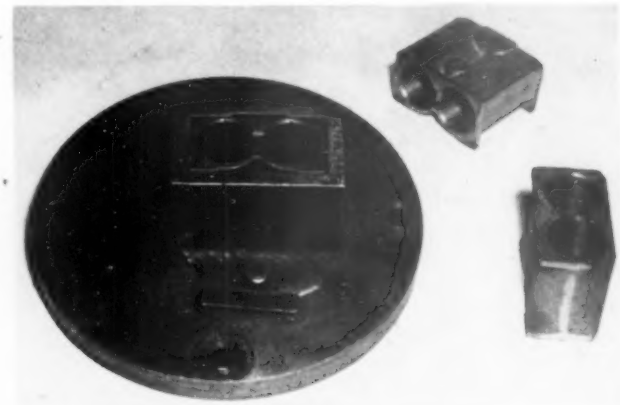


FIG. 14. Lathe fixture for boring and reaming two holes to 1.626". FIG. 14A, at right; The lathe fixture of Fig. 14, showing the off-centre plate, on which is mounted a rectangular box to hold the workpiece.



In this article, the writer has tried to stress the importance of coordination in design, and cooperation between individual executives and departments. Such coordination applies equally to small lot manufacture as well as to mass production; essentially, the only difference is quantity. A plant, and the tools of production, are necessary in either case.

While the tools of production are important, so is the frame of mind of the working personnel, from top executive to the operator on the machine. And while, as previously stated, only one man can be in charge of a department, a "pat on the back" to a willing subordinate wins loyalty and good will.

"Packaged" Selling of Service -A "New" in Contract Engineering

POSSIBLY DESTINED to set a precedent in the contract engineering field is a unique application of modern selling recently established by the Bunell Machine and Tool Company, Cleveland.

Adopting the basic principle in packaged marketing, the company breaks up its work into four separately priced step by step services that may be individually ordered without commitment for an entire program. Each step is complete and so integrated that, progressively, customer and company control costs and both know the full story at every step. The four unit sequences are as follows:

(1) The factual story, with necessary research and preliminary development together with rough estimate of the cost of work wanted. For this, there is a nominal charge. (2) Working drawings, which include the data and quotation for designing. (3) Building the sample unit, at a price not to exceed a quoted amount, and (4) building, after the okay of the sample.

By **John R. Parks**

Personal Equation of Men and Machines

Tolerances, in Inspection and Quality Control, Must Be Reduced to Known Standards

PERSONAL EQUATION relates to the ability of an individual to perform a simple task, under a certain set of conditions, as compared with other individuals performing the same task under the same set of conditions. In connection with this subject, the individuals referred to are assumed to be people experienced at doing the task, as, for example, inspectors using comparators or any measuring instrument they may be familiar with, or—as an analogy—astronomers using telescopes to check star positions. In either case, the tasks refer to measuring.

Here, the personal equation is the more important the higher the required precision. In the case of close measurements, it should either be taken into account, or steps should be taken to minimize its effect on the required precision. Now, no two inspectors are likely to measure an object with the same pressure on the micrometer spindle, and the light wave micrometer was developed to eliminate this factor.

But even here the personal equation creeps in, since no two inspectors will pass exactly the same judgement on the pattern of interference fringes that appear on the instrument. Under circumstances that do not allow for elimination of the personal equation, and where warranted, the personal equation is therefore determined by having the individual measure a known standard many times and studying the deviations of his measurements from the standard.

Machines as Well as Men

While the foregoing applies to all individuals using direct measuring devices, it also applies to different measuring machines of the same class, and considering variations, however slight, it can be said that each such machine has a "personal equation". It is not to be expected, for example, that two light wave micrometers will have the same interference fringe patterns at the same pressure.

In this case, however, the comparative precision of the instruments as a class may be such that the personal equation of each may be disregarded. The manufacturer usually takes certain precautions to make such machines within a certain tolerance; however the personal equation of an extremely precise machine is usually determined and delivered with the instrument.

The personal equation of both men and measuring machines change with time, and consequently they require standardizing from time to time according to the frequency of use. Generally, when the personal equation of a machine becomes greater than the required precision, it is either replaced or passed on to less accurate work. For instance, some manufacturers make it a practice to pass master blocks to inspection duty and then to the shop as they become worn.

The question is, how much of the preceding discussion of men and measuring machines can be carried over to production machines of the same class, duty, capacity, and manufacture? Ordinary shop practice seems to indicate that such machines have personal equations, so to speak, and the writer has overheard remarks like the following: "What's the tolerance?" . . . . "Well, perhaps we'd better put that part on machine number so-and-so." It therefore seems fairly certain that, here, the personal equation of "number so-and-so" was estimated from experience—probably bitter. If, then, it is everyday practice to guess, it would be entirely practical to know the personal equations of such machines more accurately. If so, how should it be expressed—and how obtained?

A Factual Example

At this point let us digress to briefly discuss several ideas of data analysis as presented in many good books and papers on quality control. Further, let us cite a factual example. An inspector selected the first 50 pieces of a production part from a newly set-up machine. He measured once and recorded a diameter on each part having the dimension .500″ ± .055″. In measuring he estimated to .0001″. Inasmuch as he gathered the data to determine how the dimension, as machined, is grouped around the nominal (.500″) he proceeded to make a plot of the data as shown in Fig. 1.

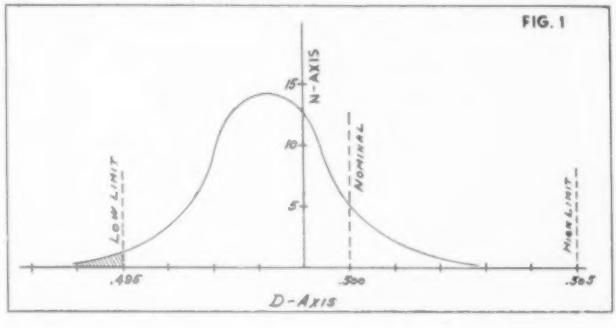
He looked over the data and found that the smallest diameter was .4942″. He then plotted points .494, .495, and so on, along the D-axis to within .0005″ of the largest diameter measured. Along the N-axis, he laid out points corresponding to 5, 10, and 15. At this point, he was ready to tabulate his data. For each point .494 and on, he counted the number of measurements that were equal to .4935 but less than .4945, and listed these numbers, in his table as corresponding to .494, .495, etc.

These numbers were the "N" numbers on the plot. He next plotted points on the graph corresponding to the pairs of "N" and "D" numbers as he had tabulated them. By using French curves and making some adjustments, he obtained a curve like that shown in Fig. 1. He then drew lines parallel to the N-axis through the points .495, .500 and .505.

This curve is an approximation to what is known to statisticians as the "normal distribution curve" for the 50 measurements. Coupled with the tolerance lines, it shows how the machine was operating to turn the diameter measured and how well the set-up was made. Using a planimeter, the inspector measured the shaded portion under the curve and divided it by the total area under the curve. The fraction so obtained is the fraction out of tolerance.

By multiplying by 100, the percent non-conforming is obtained and is a fair approximation of the percent defects of the run of the machine before a new set-up is required. Comparing the "spread" of the curve with the tolerance, the inspector was able to show that had the machine been so set-up that the .500 line has passed through the highest point of the curve the percent defects would have closely approximated zero.

FIG. 1



As already stated, this curve is an approximation to the normal distribution curve for the 50 measurements. The curve that best fits the data is gotten by calculating "N" and "D" points from the following equation.

$$N = \frac{50}{s\sqrt{\pi}} e^{\frac{-(D-A)^2}{2s^2}}$$

Where "N" is the number of parts having diameter "D"; "A" is the average of the 50 measurements and "S" is the square root of the average of the squares of the deviations, (D - A), of the 50 measurements from the average, and "E" is the base of the natural logarithm.

"Standard Deviation"

To make the more accurate plot, the inspector in our example could add two more columns to his original tabulation of the 50 measurements. These columns could be designated (D - A) and D - A)^2. By adding the measurements and dividing the total by 50 the average "A" is obtained. The (D - A) column can now be set up by tabulating the respective differences between the diameter measurements and the average, plus and minus signs being disregarded.

The (D - A)^2 column is made up by tabulating the squares of each number in the (D - A) column. The number "s" is then found by taking the square root of the sum total of the (D - A)^2 column divided by 50. Substituting the calculated values of "A" and "s" in equation (1) the equation of the more accurate normal distribution curve is obtained.

The number "s" has been given the name "standard deviation" by the statisticians and is defined as the root mean square of the deviations of a set of numbers from their mean value. This number is very important in the study of numbers distributed about some central value such as their average. It is an excellent measure of the spread of the distribution.

If "s" is relatively small it means that the numbers are "bunched" around the average and the distribution curve rises to a higher and sharper value at the average. Whereas if "s" is relatively large the numbers are not so tightly "bunched" around the average and the curve is not so high and is relatively flat at the average or central value. (See Fig. 2).

Statistical study of equations such as (1) has given rise to several very useful tables known generally as probability tables. The following table is derived from the probability tables and is useful to our discussion. For measurements taken under uniform conditions, on parts produced under uniform conditions, it is normal to expect that the percentage of the measurements as given in the table will fall between the limits given.

This table has been amply tested by data gathered from tests ranging from the ash content of coal to the tensile strength of alloy steel, and the writer has had opportunity to check the table against measurements on parts machined on an Acme Gridley. The agreement between the theory and the analysis of the data is astonishing.

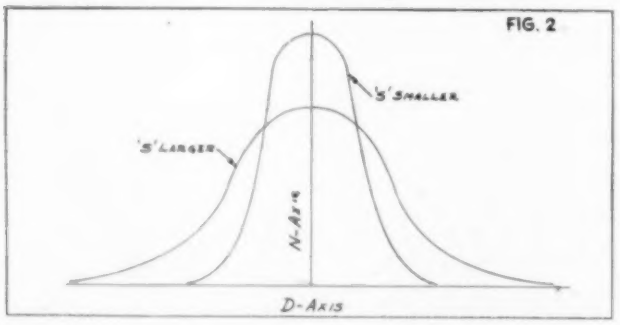


FIG. 2

Table I

Limits	Percentage Within the Limits
Average—s, Average+s	68.27
Average—2s, Average+2s	95.45
Average—3s, Average+3s	99.73

It is not to be assumed that all data gathered under uniform conditions will show a distribution as shown in Fig. 1. Rather, a distribution will generally fall into one of the three classes shown in Fig. 3. Curves "A" and "C" are said to be "skew" and are second approximations of curve "B", the normal distribution curve. A kew factor "k" can be calculated from the data. If "k" = 0, the data will give a distribution of type "B". If "k" approximates —1 or +1, the distribution curve will be of type A"" or "C" respectively.

The ideas expressed in the main body of this paper are not too greatly affected by a skew factor not equal to zero. The information contained in Table I holds true for a wide range of values of "k". The skew factor is used chiefly to obtain a more accurate idea as to how the data is distributed around the mean value.

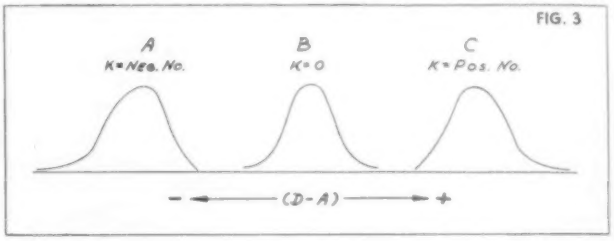


FIG. 3

Here we return to the first part of this article. The writer feels that the standard deviation, "s", very adequately fits the bill as a measure of the "personal equation" of production machines. It has the nature of tolerance as seen from Table I and statistically it is a measure of accuracy.

When a tolerance is placed on a dimension on a production part in general, it is to serve three purposes:

1. It shows what the design engineer thinks is the best condition for mating parts, if any.
2. It shows the inspection department what the customer and designer consider acceptable.
3. It shows the factory what must be the accuracy and quality of the workmanship.

This third item is most important. The quality and accuracy of the work of the factory determines the load on the inspection and assembly departments as well as the factory's scrap and salvage loads. From the viewpoint of item 3, tolerance implies that the distribution curve of the parts machined relative to that tolerance must lie wholly within the limits set by the tolerance. In order that this may be achieved the tolerance can be considered as implying an upper limit of the personal equation of the machine assigned to do the work.

Referring to Table 1, it is seen that 100% of the parts machined under uniform conditions will fall within the average $\pm$ 3.5 s. It may be possible to control the average within the mid-point of the tolerance $\pm$ s, and it may be necessary to allow another "2s" in over-all variation to account for tool wear and other such conditions that may influence the accuracy of the run. All this adds up to the following statement, viz:

The personal equation of the machine, as expressed by the standard deviation "s" on an operation, must be such that 1 is less than the tolerance given on the dimension.

In the example given, the tolerance .010 on the diameter .500 implies that no defective parts would have been found

sample and, hence, not likely to occur in the run if following conditions had been met:

If the personal equation of the machine in turning the .500 diameter on the type material used were

$$\text{less than } s \text{ (max)} = \frac{.010}{11} = .00091;$$

If the set-up had been made so that the average diameter machined was within .500 ± .00091, and

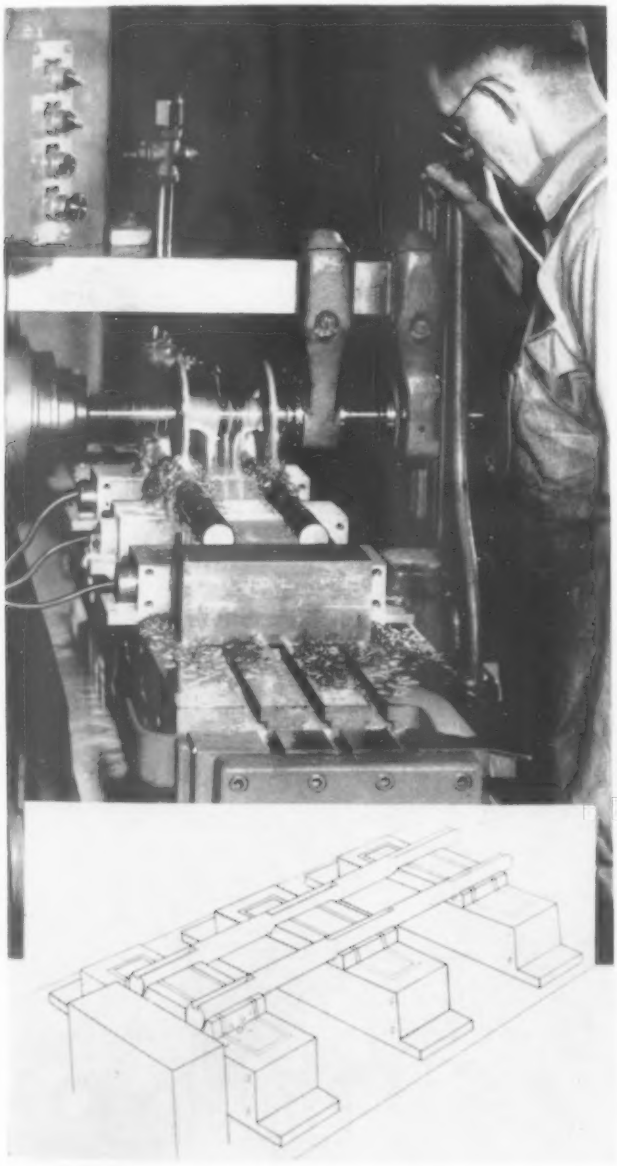
If the line inspector had checked the parts at such intervals and with such care as to detect changes due to dulled tools, among other courses.

As implied by the title of this paper, the ideas submitted here are in the main reflections of what may be termed an armchair engineer. During the war the writer had occasion to attempt to ascertain with what accuracy certain forging presses could produce different aluminum and magnesium forgings with reference to tolerances on the across-the-parting plane dimensions.

Unfortunately, the pressure of production shoved the endeavor to obtain data under uniform conditions so far into the background that sketchy estimates, based on a few findings, were finally used. However, the problem has remained to titilate the writer's mind, with this paper as the result. It is hoped that these few ideas will be considered by someone who has looked more deeply into this problem, and who has gathered data that will throw some light on the points discussed herein.

Magnetic Chucks Aid in Milling Keyways

THE USE OF MAGNETIC chucks to hold steel-bar workpieces, during the milling of keyways (illustrated), reduced loading and unloading time to just a few seconds. The particular job shown was performed on a Sundstrand Automatic Rigidmil, with workpieces of steel bar 2″ dia. x 25″ long.



Keyways 5″ long by ½″ wide x .300″ deep are milled at the center and at both ends, using 6″ dia. x ½″ wide staggered tooth H.S.S. side mills. Feed rate is 7.13″ per minute with rapid traverse at 300″ per minute. Three Rockford Power-Grip Viking Chucks with V-block fixtures are used, together with end stop. In this case, two bars are milled simultaneously, but as many as six bars can be milled with a similar set-up. The chucks used are manufactured by Rockford Magnetic Products Co., Inc., 1302 18th Ave., Rockford, Illinois.

Ni-Hard Castings Machined With Carbides

CASTINGS OF NI-HARD—an alloyed, heat treated white iron with Brinnell hardness ranging from 550 to 700—are generally finished to shape by grinding. These castings, however, have been successfully machined with tools of Carboloy cemented carbide. A 6″ mine pump casing of Ni-Hard is shown being finished on a boring mill at Barrett-Haentjens & Co., Hazelton, Pa., with Carboloy 44A tools.

Rough cuts as heavy as .075″ are made, with a feed of .020″, on a 20″ bore, using a speed of 5¼ RPM. Finish cuts of .015″ are made with a .020″ feed. Use of carbide tools practically cut in half the time formerly required for grinding.

Comparable savings are made by boring Ni-Hard wear plates and on special cuts such as turning a 45° angle on the casing face. Further information on this type of application may be had from Carboloy Company, Inc., Detroit 32.



By Gunnar Skog

The Turbojector–A New Process in Rubber Molding

In which two proven principles combine to make a new machine

IN CONVENTIONAL PRACTISE, rubber products are formed by compressing uncured rubber compound in molds, with pressure and heat applied until the rubber is vulcanized. While molds are relatively inexpensive and rejects few, scrap loss is high, time cycles comparatively long and considerable hand labor is required for finishing. Continuous extrusion is also used although, with that method, products are limited to uniform crosswise sections.

Latterly, a relatively new method—transfer molding—has been introduced to industry. With this method—which is mainly confined to small items—material must be preheated, either by hot plates or by high frequency dielectric equipment. The first is not highly satisfactory, since the outside "sets up" ahead of the inner core, while the latter, although entirely satisfactory, is comparatively expensive.

Now, by means of a specialized screw feed unit, developed by the Hydraulic Press Manufacturing Company, Mt. Gilead, Ohio, in cooperation with Chrysler Corporation engineers, rubber may be formed by injection molding. Patterned somewhat after the manner of a conventional rubber tuber, the new development—called a Turbojector—permits rubber to be injected into closed molds with many advantages over previous methods.

Processing the raw material as it is being injected, the usual stock preparing operations, which consume time, are considerably reduced if not entirely eliminated. No "preforms" are necessary, since the stock may be fed into the injection head directly from the tubers or from strips cut from "warm-up" sheets on the rubber mills, or, since the action of the feed screw (worm) warms the rubber, it may be taken direct from storage in strip, rod, or slug form. No preheating is necessary, the Turbojector forcing the rubber into the mold cavity at an elevated temperature but slightly below that of the mold.

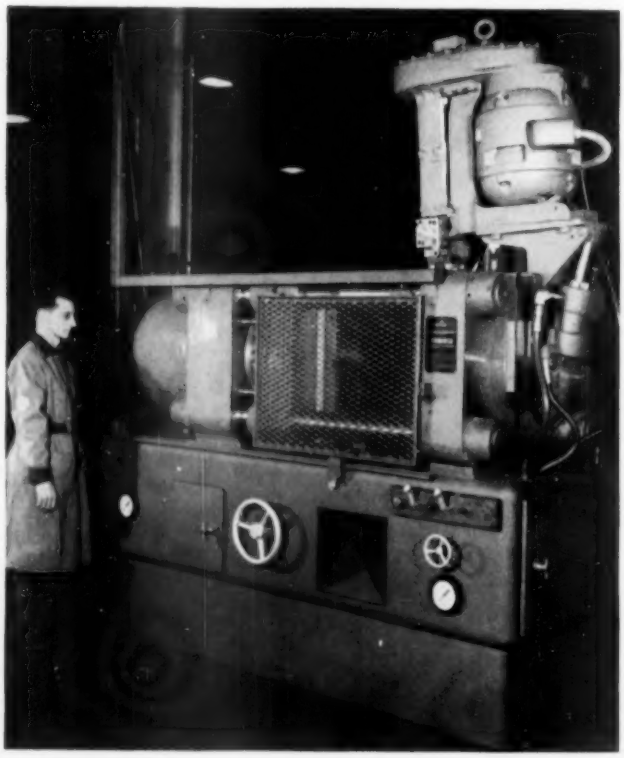
In the new development, the injection head represents the unusual design consideration. Incorporating the mold clamping equipment, this operates as follows:

Material, fed from a hopper, is introduced near the top of the worm where, in its downward passage, it becomes uniformly heated, masticated, and mixed as a result of friction and the turbulence effected by the worm. In its travel, the material is split into two halves by means of baffle gears, the action of which creates more turbulence and more friction and, consequently, more heat. Once past the baffle gears, at which point the material has been heated from 120 to 220 degrees, and is quite plasticized, the two halves unite and completely fill the threads of the worm.

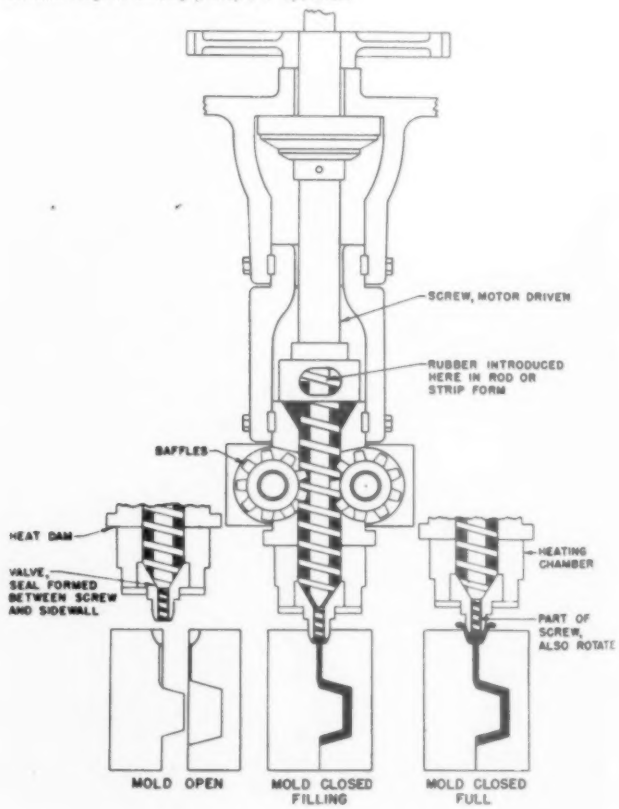
Progressively heating as it reaches the end of the worm, the material is filmed over the conical end and forced into a circular cross section through the nozzle and into the mold. As soon as the mold is filled, the rubber extruding from the nozzle tilts the injection head and causes an electric contact which momentarily reverses the screw and stops its rotation. A check valve prevents the rubber from backing up.

The foregoing explains the essential principles, which are further clarified in the sectional diagram. The interesting consideration is that rubber gaskets of various shapes, as well as complete "pans" up to four pounds in weight and of area up to 90 inches, can be molded on the smaller machines.

H-P-M Turbojector applied to injection molding machine.



Sectional diagram showing principle of operation.



By the **Broaching Tool Institute**

Practical Applications of Involute Splines

Extremely flexible, the involute spline is solution to many design problems

SINCE THE INTRODUCTION of the new American Standard for Involute Splines last year (first published in the 1946 Edition of the SAE Handbook issued by the Society of Automotive Engineers), designers in all manufacturing industries have become intensely interested in the application of involute splines to their own unique design problems. Considering that straight-sided splines in one form or another have been the standard practice for something over 30 years, it will take some time before the new practice will be accepted as a matter of course. Consquently, it is important for designers to become acquainted with involute splines as quickly as possible.

Stemming from a long background of engineering thought and experience the new Standard is extremely flexible so as to meet the many design problems in the field. Involute splines can be used whether one has large volume or only a few hundred pieces per year; and in some industries it is applicable to the making of only a few pieces at a time. Flexibility, therefore, is one of the chief attributes of the standard.

Involute Spline Broadly Applicable

Generally speaking, the involute spline is applicable to motor vehicles, machine tools, aircraft parts, tractors, industrial machinery and drives, earth moving machinery, and many other places where straightsided splines have been employed in the past.

Let us consider a few of these applications. Earth moving machinery is not made in large volume but represents a major investment for the road building and general construction industries. At the present time, some shovels in this category are being built in capacity up to 35 cu. yd. This is an enormous piece of machinery and in keeping with the modern design trend it must have adequate strength without the penalty of undue weight. On the other hand, an efficient streamlined design must give assurance of strength and long life consistent with the gruelling service expected of such machinery.

Several of the progressive companies in this field have begun the redesign of the entire machine to accommodate involute splines for power line shafting of every kind. As described in a previous article,* the involute spline can be produced to such fine tolerances as to assure proper mating of all teeth and, consequently, assure full design capacity. This is seldom true with straight-sided splines and frequently the entire load is carried by a single tooth. With the old method, even oversized shafting could not insure against failure, while the new standard makes it possible to use much smaller shaft sizes (consistent with torsional rigidity) capable of carrying design loads without failure.

In short, the involute spline offers engineers a construction in which design calculations can be made to predict safe operating conditions. This means that shafting and drives can be reduced in diameter and yet give better life than ever before. When shafts are made smaller, the rest of the mechanism—gears, flanges, collars and other components—can be correspondingly reduced, thus resulting in a better balanced machine without the weight penalty imposed by the time honored "factor of ignorance."

Even ship gear, as made in small lots by the large shipbuilders, can profit from the adoption of involute splines. These can be used in shafting for auxiliary machinery such as davits, cranes, hoists, and other machinery. The major requirements in ship machinery are adequate strength and freedom from fatigue failure. Involute spline construction assures this through the design of shaft sizes which can be calculated in advance with full assurance of freedom from failures.

One might think that involute spline shafting, for the small lot production in shipbuilding operations, might not be a practical method. Actually, the reverse is true because of the flexibility of the process and the short-cut methods offered by the makers of spline tooling. For example, it is perfectly feasible to cut the shaft splines to accurate tolerances, by index milling, and to broach the bores with a single key broaching tool which can be indexed around to cut one spline at a time. This is not mass production but, for single pieces, it is an economical procedure.

Similarly, involute splines can be adapted to meet the requirements of railroad couplings, and for the gamut of industrial drives both large and small. The new standard is particularly valuable for large industrial drives because of the possibility of reducing shaft diameters while, at the same time, increasing the load carrying capacity of the smaller members.

Some work already has been done in the application of the principle to the design of military ordnance, particularly for elevating and traversing mechanism. Here we have relatively large volume, thus permitting the adoption of latest production methods. In the development of ordnance mechanism, economy of size and weight, and the assurance of design capacity mark unquestionable advantages for the involute spline.

Standard Is Highly Flexible

The progressive manufacturers of small industrial equipment and business machines—using small or even tiny elements—will find it profitable to explore the advantages of involute splines. Here again, the flexibility of the standard, extending as it does to the very smallest of shaft sizes, proves its utility. In many cases, shaft sizes for the small machines and instruments cannot be made much smaller; however, involute splines will give designers an opportunity to develop the smallest drives capable of carrying maximum loading without fear of failure.

Machine tools use considerable shafting of every description to which the involute spline may be profitably applied. Some of the manufacturers in this field are studying the mechanism of new models to determine the most practical points of application.

Producers of tractors and earth moving machinery have been making considerable progress in the utilization of the new standard. To give some idea of the variety of applications in the picture, we list below the names of parts now under study:

LIST OF PARTS FOR TRACTOR MANUFACTURER A

1. Final Drive Gear
2. Sprocket Shaft
3. Intermediate Shaft
4. High Speed Range Pinion
5. Pinion Shaft
6. Pinion Low Speed
7. Top Shaft
8. Pinion 2nd Speed
9. Gear 2nd Speed
10. Gear 3rd Speed

*"Engineering Aspects of the Involute Spline," Iron Age, April 3, 1947.

LIST OF PARTS FOR TRACTOR MANUFACTURER B

1. Clutch Shaft Gear
2. Flywheel Clutch Hub
3. Flywheel Clutch Driving Plate Bearing Sleeve
4. Upper Transmission Shaft Front Sliding Pinion
5. Lower Shaft Sliding Pinion
6. Steering Clutch Control Drive Pinion
7. Upper Transmission Shaft Thrust Washer
8. Flywheel Clutch Shaft Coupling Flange
9. 4th and 5th Coupling Collar
10. Cable Control Clutch Thrust Plate
11. Clutch Shaft Gear
12. Rear Power Takeoff Sliding Pinion
13. Clutch Driving Drum
14. Coupling
15. Final Drive Gear Hub L.H.
16. Final Drive Gear Hub R.H.
17. Upper Transmission Shaft Low & Reverse Gear
18. Reverse & Forward Pinion
19. Belt Pulley Drive Bevel Pinion

LIST OF PARTS FOR TRACTOR MANUFACTURER C

1. Drive Pulley
2. Steering Worm Wheel
3. First & Reverse Sliding Gear
4. Second & Third Sliding Gear
5. Rear Axle Drive Gear
6. Differential Side Gear

LIST OF PARTS FOR TRACTOR MANUFACTURER D

1. Clutch Collar
2. Reduction Gear
3. Master Gear Hub
4. Belt Pulley Drive Shaft

To the user, the most valuable feature of the standard comes from the progression of fifteen (15) diametrical pitch sizes ranging from ½ to $^{48}/_{96}$, and encompassing the gamut of commercial shaft sizes from the largest industrial machinery drives to the finest splines used in aircraft and for small instruments. Discarding old practice, the standard provides for any desired number of teeth from a minimum of six, for small shafts, to as many as fifty for large shafts.

Another boon to the designer is the specification of a range of dimensional tolerances on both the shaft and the bore, thus relieving him of the onerous task of calculating the tolerances for each application.

Production economy is the predominating keynote of the standard. Instead of the old method which provided three depths of tooth—shallow, medium, and deep—the involute spline is based entirely upon a 30-degree pressure angle involute with but *one* standard depth. Consequently, the entire range of 15 DP sizes requires but 15 standard hobs to cover all requirements. Moreover, each hob for a given DP can be used to cut all shafts within the given DP range, regardless of variations in shaft diameter and number of teeth.

Reduces Cost of Broaches

As in the case of the standardized hobs, the new method offers a marked advantage in reducing the cost of broaches for experimental jobs. The first cost, of an involute spline broach, is high if only a few pieces are required for an experimental run. It is usually almost impossible to locate a standard broach of exactly the right kind for a hurry-up job. From now on, however, the picture will change appreciably. Once the new standard has been generally adopted, and the broaching tools are standardized, it should be possible to secure a broach of exactly the right specifications for any new job from a source already using the same tool. This is particularly true of the large automotive plants where broaching is done in many departments and in different divisions.

To summarize the foregoing, it may be noted that the new Standard offers the following advantages to the designer:

1. Ability to calculate shaft size within reasonable engineering limits. This is not feasible with the old spline standard.
2. It offers the possibility of reducing shaft size, particularly for large machinery, where shaft size has had to be made considerably greater in the past to compensate for the shortcomings of the old spline standard.
3. It offers reliability—freedom from failure—owing to the nature of the fits in the new Standard and the assurance of ability to distribute the load over all of the spline teeth.
4. Finally, and importantly, the Standard offers a new level of production economy not only on large runs but for small lots and experimental runs.

New "Matched Set" Simplifies Tool Steel Selection

A NEW AND IMPROVED set of Matched Tool Steels, developed by the Carpenter Steel Company, Reading, Pa., is designed to provide tool and die makers greater simplification in the selection, heat treatment and use of tool steels. For while, in recent years, air-hardening tool steels have proved themselves invaluable for jobs where minimum distortion in heat treatment and elimination of hardening hazards are essential, it has been found that the large variety of available grades complicates the problem of finding the one best steel for each job.

Now with the addition of three Air-Hardening Tool Steels to the Carpenter "Matched Set," the right steel for the job can be selected with greater assurance. Where extreme wear resistance and good toughness are needed, No. 610 (Air-Wear) is recommended by the maker. For jobs where an ideal condition of wear resistance and toughness is essential, No. 484 (Air-Hard) may be used. Vega (Air-Tough) is used for tools that require extreme toughness with good wear resistance.

Two new members—TK (Red-Hard) and No. 383 (Red-Tough)—have been placed in the Red-Hard Matched Set. Respectively, these combine greater hardness with improved toughness, and extreme toughness and greater red hardness.

The 12 steels that make up the complete Carpenter Matched Set are so inter-related that each takes up the work where the other leaves off. As a result, tool makers can actually know in advance what results to expect as they move from one steel to another.



By **Karl Stad**

Cam Units Cut Manufacturing Costs

Using Cam Feed Units, completely automatic station-type machines are being tailor-made for the job

WHILE THE MAJORITY of tools, currently being developed, are designed to increase production and, consequently, to cut costs, actual results are more interesting than mere possibilities. With recently designed A-65 Cam Feed Units, by National Automatic Tool Company, Inc. Richmond, Indiana the output of master cylinder bodies in the plant of one of the world's largest automobile manufacturers, has been stepped up three to four times as compared to previous methods.

These units, which have been especially designed to reduce manufacturing costs, as where mass manufacture of small parts had to be stepped up to meet modern needs, are readily made up into special station-type machines. For example, the complete automatic machine shown in Fig. 1, below.

This machine provides a 6-position air index table, with spring clamping fixture, for production of cover and compensating holes in the master cylinder body mentioned above. The parts are shown in the smaller photo, Fig. 2, and also in the line drawing, Fig. 3, which also shows the six positions—or stations—for machining.

At Sta. 1, load and unload two parts; at Sta. 2, drill four

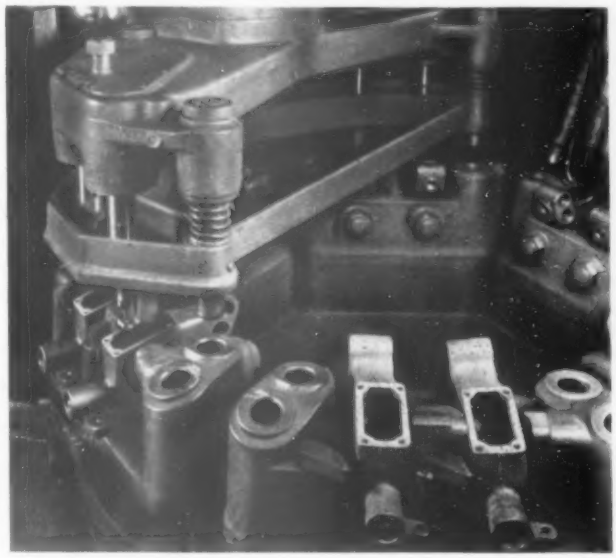


FIG. 2 above.

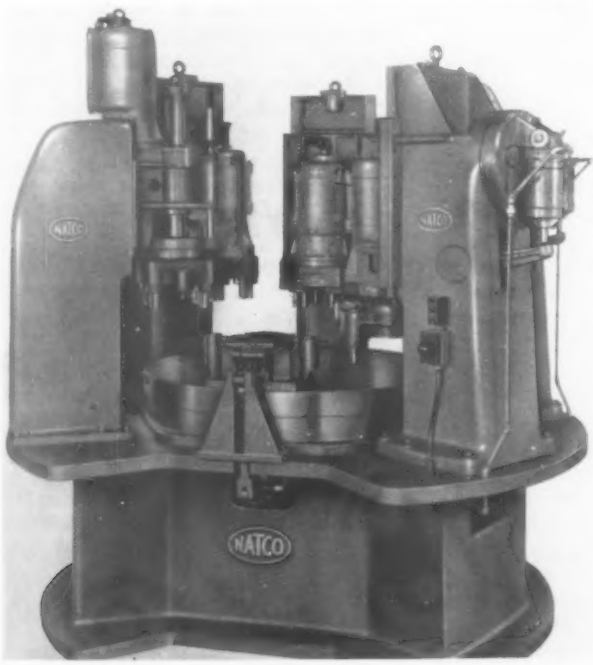
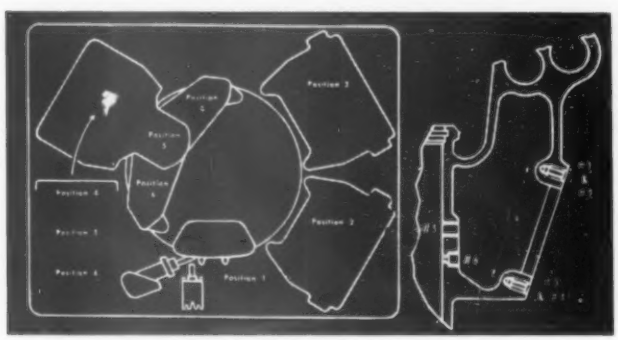


FIG. 3 below.

13/64″ holes, No. 1 to No. 4; at Sta. 4, drill one 5/32″ hole (No. 5) in each part; at Sta. 5, drill one ¼″ hole (No. 6) in each part; and at Sta. 6, drill one .028″ (No. 6) in each part.

As may be judged by Figs. 2 and 3, each of the units, including the head, occupies a "pie-shape" which makes the units easy to fit together around the circular table. An interesting feature is the single head, covering three positions —Stas. 4, 5 and 6. As set up, this machine produced more than 400 parts per hour, loading two parts at a time and completing the cycle in 18 seconds automatically.



Guards Lengthen Gage Life

ACCORDING TO A RECENT announcement by Ford Motor Company engineers, extra wear and protection for Johansson Gage blocks has been achieved by use of tungsten carbide guard blocks of super hardness. The guard blocks, which come in thicknesses of 0.100″ and 0.050″, are available in both the A and B standards of (plus or minus) .000004″ and .000008″. The guards are simply wrung on to the end of any Jo-block combination and will fend off virtually all of the impact and abrasion of any gaging job.

As the gage blocks are fabricated from the finest stabilized steel, the addition of the guards will enormously lengthen their usual long term of service.

Show Review in November

SINCE WE WENT to press coincidentally with the Machine Tool Show, review of the exposition will necessarily have to be deferred until November. In this connection, it would be a mistake to assume that the closing of the Show cancels out its newsworthiness. For, while the Show was big news in itself, its purpose was to display the latest in tools for manufacture. And these tools will continue to be news long after the closing of the Show—at least until they, in turn, are obsoleted by newer developments. For now, however, those who could not attend will have opportunity to see highlights of **The Machine Tool Show in Review**, November *The Tool Engineer*.

By H. T. Thompson

A New Method of Making Electric Connectors

Progressive die reduces waste, improves product and production

FOR A NUMBER OF YEARS, the Railway & Power Engineering Corp. Ltd. has been making small electric connectors or "pigtails," as they are sometimes called. The connector consists of a short length of flexible copper wire with a piece of copper tubing swedged onto either end. On one end, the tubing has a round hole in it and the other end is forked.

Recently we designed the new die which is shown in the photograph, and are having great success with it. The tubes are cut off double the length required to make one end, plus $\frac{1}{8}$", which is wasted in trimming. The flexible wire is cut off in lengths of about twenty feet and the tubes are threaded onto these lengths. A knot is made in each loose end of the wire so that the tubes will not drop off. The wire is now ready to be fed through the die.

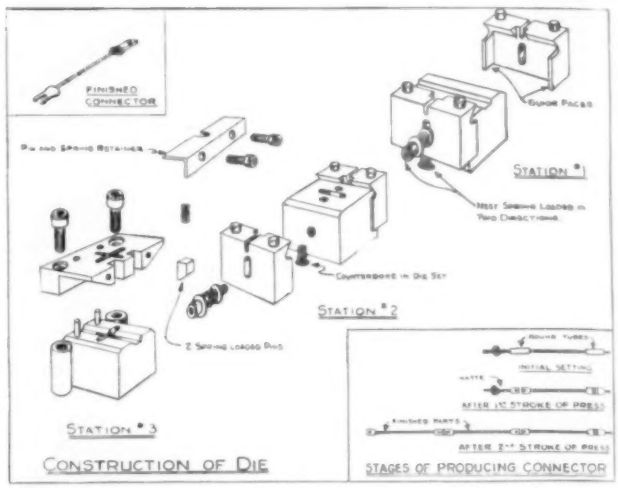
H. T. Thompson **is tool designer with the Railway and Power Engineering Corp., Ltd., Toronto, Canada.**

The first two tubes are pushed into the nests on stations No. 1 and 2 respectively, with the knot on the end of the wire lying between stations No. 2 and 3. The press is then tripped. This gives us a completed end at station No. 2 and a flattening operation at station No. 1.

The whole wire is then moved to the left so that the completed end from station 2 drops over a locating pin. The tube flattened at station 1 is now at station 3 and a loose tube is dropped in each of the nests at stations 1 and 2. On the second stroke of the press two connectors are completed. For each consecutive stroke of the press two connectors are made—that is, until the length of wire is used up.

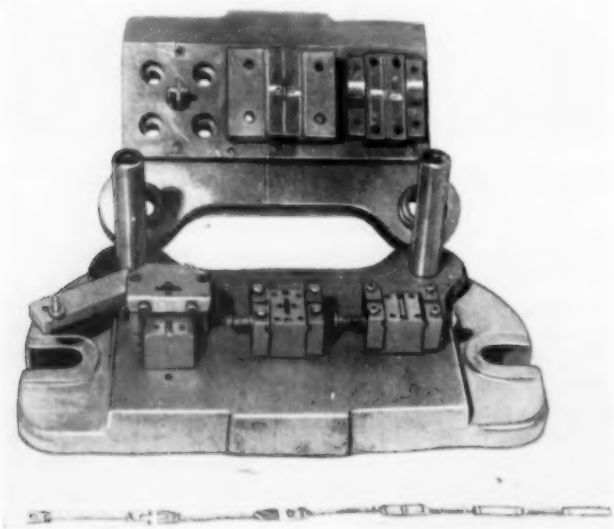
A new cycle is started with each length of wire. In the operation of this die we found it advantageous to cut the flexible wire in lengths rather than trying to thread a complete reel. When we threaded a complete reel all the tubes were inclined to slide to one end.

As can be seen from the diagram the nests at stations No. 1 and 2 recede on the down stroke of the press. This allows the tube to increase in width without "jamming" in the nest. At station No. 3 we have a solid type stripper which is open on the front with two spring loaded pins that locate the flattened tube during the operation.



An interesting point on this die is the fact that, when setting the press, the set-up man can adjust the ram so that the flattened tube at station No. 1 will be the exact width to fit between the back face of the stripper slot and the spring pins at station No. 3. This guarantees the slot in the forked end being dead center.

The method, shown here, more than doubles the production obtained previous to its installation, and the parts produced are uniform and of good finished appearance.

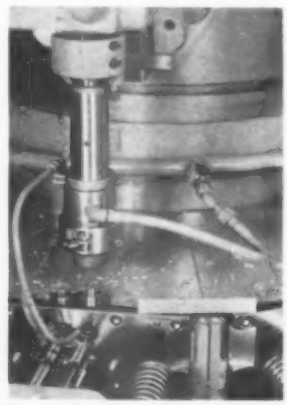


Threading on Close Centers

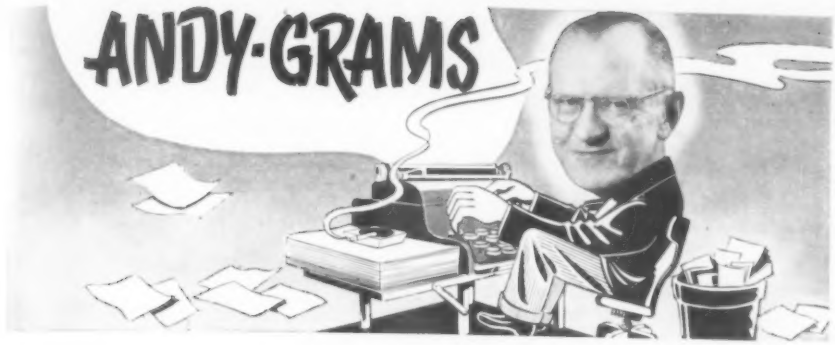
A PRODUCTION PROBLEM that crops up now and then, and which usually presents difficulties, is external threading on close centers. Typical of such a job is the washing machine mixing valve, shown in the smaller photo, which has two $\frac{3}{4}$" stright pipe threads on centers so close that threading with ordinary dies would be extremely difficult if not impossible.

The threads are being cut with a special H & G solid adjustable die head, developed by the Eastern Machine Screw Corporation of New Haven, Ct., and equipped with insert chasers. The machine shown is a Kingsbury, and production is at the rate of 350 pieces per hour for both threads. The job not only indicates good tool engineering, but may be considered a rather outstanding threading accomplishment.





ANDY-GRAMS



SO MANY THINGS have happened the past month that, at risk of boring you boys North, East, West, South, I may have to take more than my allotted page. We'll see. Right now, I'm at the Big Show in Chicago—or rather, in my room watering my panting dogs and trying to unscramble my notes. It's all too muddled for any coherence or consistency.

Now, starting from where I left off last time, I took a flyer to Toronto Chapter, where I gave the double O to a work on Aluminum Drawing, by John Lengbridge, which should make mighty "good reading." At the meeting, *tete-a-teted* with Arnold Thompson, looking right chipper in spite of the responsibilities of the war years.

Asked by Ch'man Ike Jardine to say a few words, I did so, then, in the post-meeting-handshaking, got acquainted with Doug Cooper, lately Ch'man of Lakehead but now domiciled in Toronto. Seems that, in the shuffle, Doug lost out on the past Ch'man's button that the P.C's take a lot of pride in, and I said I'd mention it offhand, like.

Reminds me of that bronze placque the boys voted me about 10 years ago, but which by tacit consent is now reserved for a headstone when I write *finis* to my book. But, let's not keep a right guy like Doug waiting that long.

After the meeting, Eric Crawford and Walt Appleton took me to the Canadian National Exposition, where everything from pumpkins to machine tools were displayed in a riot of colored light. Then, there were fireworks that made the shows put on by the boys on Federal Hill (Prov. R. I.) look like penny sparklers by comparison. A super-duper Show!

On return to Detroit, had a call from Harry Conrad asking me to entertain a member-at-large from Sweden—Wm. (Bill) Sjöstedt—who is ch'f tool designer for Scania-Vabis, Sweden's largest builder of trucks and busses. Smörgåsbording at the Stockholm, ran across local ASTEer Gunnar Karlström and another visitor from the other side—Hjalmar Hurtig, ch'f eng'r for Köping—who is an old buddy of Bill's. Yep, it's a small world.

Took Bill around to Midland Steel Products, where I met old buddies, then to Detroit Tap & Tool Company, where prex Swen Hellstrom showed us how they make good taps. Then to Ex-Cell-O Cor'n, where v. prex Thor Olson showed us around and then turned us over to Stewart Elliott, who expanded with pride as he extolled the qualities of Ex-Cell-O tools.

The highlight of the plant tour was these machines for making and filling these paper milk bottles. They come off the line faster'n 77 octopusses could milk 154 cows. About all the machine needs, to make it entirely self sustaining, is a synthetic cow. Later, Bill visited Gairing Tool, Carboloy, Colonial Broach and Michigan Tool, among other concerns, but I couldn't be with him on those trips.

A review of Mss. for coming issues, and a look-see through two new books. One, by Dr. Raymond Nauth—*The Chemistry and Technique of Plastics*—received rather inadequate coverage in a previous issue, due to last minute cropping to space. Doc, it seems, gives credit to about everybody but himself for a fine piece of writing, the book being dedicated to the engineers who, in tooling and plastics, materially advanced the day of Allied victory.

The other book—*Applied Math*—by O. B. Jones, prex of Detroit College of Applied Science, applies patly to tool engineering. So does the frontispiece—a tree bearing fruit such as Adam never dreamed of when he plucked the fateful apple. That too, will make "good reading."

Having a breathing spell, hied me to Mt. Gilead, Ohio, where Hydraulic Press Mf'g Co. unveiled a number of new developments, one of which—the Turbojector—should appear in this issue. All of these gadgets are attracting a lot of attention at the Show.

Next, to Springfield, Vt., where Bill Young and John Gibson, along with Floyd McArthur of Jones & Lamson, took me under their composite wing. Lunch at the Paddock, where good food was served by natural peaches'n'cream waitresses. Seems Kilroy hadn't been there.

On the way into town—and Springfield is a charming community built like a roller coaster—we saw Alan Brown, erstwhile with Nichols & Sons but now adv'g mg'r with Bryant Chucking Grinder, taking movies of visiting celebrities. So we said "hello" and Alan showed us through the plant where Bryant machines are grinding to .7 microinch with a 60 grit wheel. Smoother than smooth!

Next to Jones & Lamson's, where I found the Senator away on his new job but met brother Ernest Flanders, as right a guy as you'll meet anywhere. Also met Don Mellor, who sent greetings to Clarence Etter. Like the Bryant plant, the J & L is as modern as tomorrow and so spick 'n' span that it could serve as a model for Spotless Town.

At the meeting, held in the Fellows Gear Shaper Company cafeteria—and a swell feed we had!—and presided over by Alan Stubbs of J & L, I met about everybody "Who's Who" in Springfield although, in the hum of conversation, I failed to catch all the names. But, there was Fred Miller, prex of Fellows, and Ed Fellows—scion of the founders, Bill Farrel of Cone Automatic and past Ch'man of Springfield Chapter, and the several Chapter officers including Bill Hadfield. A fine gang o' men—typical ASTEers.

Sitting at the head table was a visitor from Sweden, Ernest Lundén (g.m. of Lundén & Bonthron) who, after I'd muddled through my talk, quite won the boys over with his comments on American customs. Seems it was the first time he'd ever attended an engineering dinner without "schnapps." So here's to you, Ernest. Skoal!—in ice water.

Pulled out too early in the morn for a visit to the Fellows plant, but figured I'd see the machines working at the Chicago show. On the way to Boston—a scenic delight!—we stopped at the Kingsbury plant, Keene, N. H., where I met Gunnar Swahnberg, v. prex, who showed me around. After having seen the Springfield plants I was beyond surprises, but Kingsbury can stand as a model for harmonious employer-employee relations. I wasn't surprised that, at the Show, the Bryant, Jones & Lamson, Fellows and Kingsbury exhibits should be jam-packed with prospective buyers.

At the meeting of Boston Chapter, met John Sylvester and Warren Ames among *auld acquaintance,* also George McGinley, with whom I worked as a designer, in Providence, back in '10 or so. Time flies! Ch'man John Ryneska—a fine young chap to whom I took an instant liking—introduced Boston's famous gadgeteer, Walter Pohle, who demonstrated his latest wrinkles along with a string bean cutter especially designed for (his) friend wife. As usual, Walter went over in a big way.

Next, Jos. W. Powell, Jr., v. prex of American Research & Development Corp', who explained the workings of his company like a born orator. Bill Young then introduced me, making some crack about my thinning locks, but I fixed him for that, the young coot! In my talk—of which the less said the better a/c I rate near zero as a speaker—I outlined my plan for a gravity bedpan but Joe Powell said someone'd got in ahead of me. So there went my dream of becoming a captain of industry, let alone a benefactor of mankind.

At the conclusion of my talk, the boys presented me with a book, autographed by John Ryneska and all the past Ch'men, and Bill Young. Totally undeserved, it was, but it made me feel good. Thanks a lot!—it will be included among my cherished possessions. In passing, I might say that Al Forbes' signature stood out like John Hancock's on the Dec'n of Independence.

Next day, to the General Electric River Works, where Louis Nielsen of the Manager's staff started me on a plant tour that included everything but the restricted area. Gus Berg, sup't, A. W. Jacobson and Frank Dahlberg,

head planner, each took me in tow and added to my education—and, along with Henry Richards and John Ryneska, to my material comfort at an excellent luncheon. For all that, my hearty thanks.

A couple of days in Detroit, there to put the October book to bed if not to tranquil rest—i.e., all but this writing—and off to Chicago for the Show. And here I am, having met again almost everybody mentioned above and hundreds of *auld acquaintance* besides. Bill Ormondroyd and Gus Hoberg of Taft-Peirce; like myself, Gus has grown out at the top since we worked together almost 35 years ago.

Worming my way through the press at the Hardinge exhibit, gave Ray Morris a lesson in basic Swedish a/c visitors from my native heath took him for a landsman owing to his size. Red Cole, talked into near laryngitis at the Warner & Swasey exhibit. A "helloyouson-of-a-gun" with v. prex d'Arcambal of Pratt & Whitney and a Joosh story with adv'g mg'r Ed Shultz—i.e., after I managed to get to 'em.

Bainton and Graves of Brown & Sharpe's and, a spit image of his dad (Lewis D.) young W. H. Spence. I see where a lot of the B & S old timers are handing the reins to their sons. A get-together with Dr. A. O. Schmidt, of Kearney & Trecker, which left me considerably wiser and the scientist from K & T possibly some so. To me, a most enjoyable interlude.

At The Tool Engineer booth, an endless stream of members and friends. E. A. Doogan, to ask if I didn't know any Irish tool engineers. Well, there's Skinny Doogan's old man, for one. Anyway, can I help if a few(?) Scandinavians got into the Society? As for that, I always thought Ed was of the clan d'Ougan, of Normandy, which in turn sprang—uh, excuse it please, I mean descended—from the Viking jarl What's'name. I'm a bit rusty in history, but those boys got around.

Seriously, however, I mention people as they're met. An' divil a bit have I got agin' any of 'em; if they're in our game, they're all swell boys. Missed Ed Dickett in the crowd, but had a letter, while in Chi, from V. Ch'man Nelson, of Rockford, inviting me to visit. I'm afraid it'll be a cold day when I get around to it—say next January. O.K. by you, Nelse? Homer Briggs and Rip Collins, along with John Lapham and others from down Texas way. Just haven't got room to mention everybody.

Friday night, the joint session of the ASTE and the American Foundrymens' Ass'n, where it was duly impressed upon us that cast iron is very much a tool. Sunday, an all-day session with the Editorial Com'tee. They always keep me worried, but nothing ever happens—just sit there waiting for 'em to throw the other shoe. Heluva note! But seriously, these com'tee meetings are like Board meetings of a big corporation—and that's just what the ASTE is now. Big business, only we'll continue to keep this a *friendly Society*. Eh?

Nothing so lonely as a big city, which is why I like the woods. I've been sitting pretty much by myself, nights, but Slim McClellan took me along with the Gairing Tool gang, one eve, and dined me at the Shangri La. Dunno what I ate—couldn't see in the gloam—but it all tasted tops only too much for my comparatively limited capacity. Thanks, Bill!

An interesting meeting with Mynherr P. Konig, from the Netherlands. The invading Nazis had looted his plant of all equipment, then, on retreating before the advancing Allies, had dynamited his buildings. Now, he is starting anew. Also of great interest was a meeting with Eugene Lahr, erstwhile of London and the Continent but now located in San Paola, Brasil. (That's right, it's spelled with an s, not a z) I've had considerable correspondence with Gene who, as it turns out, is a clear thinker with a firm grasp on international affairs and a charming conversationalist as well.

In looking through my scrambled notes, I find that I promised T. H. Ljunggren, development engineer with Bryant Chucking Grinder, a resume of my talk at Springfield. The same goes for John Ryneska of Boston. But, the steno assigned to the typing couldn't read my writing, not so surprising since I can hardly read it myself. Now it's too late. Sorry! Also, I want to belatedly acknowledge a letter from Prof. W. A. MacCrehan, of New York University, in which he expressed regret at not hearing my Boston talk. You missed nothing on that score, Professor, and the regrets are all mine at not having had the pleasure of meeting you.

Now, coming back to the Show, it's so jam-packed with visitors that you just about have to walk sideways. And don't think that the big companies attract all the attention, although exhibits like Potter & Johnston, Gisholt, Sundstrand, Baker Brothers, Ingersoll, along with Cincinnati Milling Machine and many others, draw crowds that make close approach to the machines a matter of time—and caution. As I told one guy who nearly poked my eye out: "It's okay, brother, I've got one eye left."

Harry Hauck, of Goss & Deleeuw, all enthused over a machine that performs all operations, including threading, on 3-way fittings in the time of one. Quite a gadget! Eastern Machine Screw Corp'n, threading compression couplings faster'n a magician could load 'em. Been trying for two days to talk to Roger Waindle, at Elgin's Sapphire Products Div'n, but can't get near him for the crowd at the booth. That is, I don't want to interrupt important business.

Seen in the crowd, George Keller, grandpopping now; Joe Siegel; Al Nancarrow at the Buhr exhibit; Joe Lannon and son—long time no see. Herman Ortegren, of Bower Roller Bearing Company; Tom Bradford, of Anderson Oil Company. Bearings, lubricants, coolants, pumps, detergents, floor sweepers—they're all important tools in today's scheme of manufacture.

Paul H. Winter, ASTEer who has contributed to The Tool Engineer; prex Bryant of Cleereman Machine. A solicitous enquiry, of Jim Scott of Van Norman Machine, to ask if his alligators are still slithering. I gathered that they ain't—they're being annihilated under an avalanche of new machine tools. Everybody seems to like The Tool Engineer.

Mattison grinders, surfacing yard-wide steel sheets at one pass. Smooth and clean—wonder if it isn't cheaper than pickling? Bill Smila, sporting one of those steel canes turned out by Cincinnati Shaper. Tried to buy it for a dime—they're worth lots more but you know me for bargains—only Bill held out for inflation.

Great interest in Michigan Tool, National Broach & Machine, Orlando Gear Checker and Illinois Tool Works exhibits. Same for Gear Grinding Machine Co., Barber-Colman, Gould & Eberhardt, Gleason, Cleveland Hobbing Machine, Fellows, Pratt & Whitney and all the rest in gear cutting, finishing and checking tools.

Turret lathes, boring mills, chucking machines and automatics that, combining electronic and hydraulic controls, all but think. A new dividing head, coming as a surprise package, that provides any number of teeth, primes included, without an index plate. Can't begin to tell you about 'em all here, but look for our Review issue.

Visitors from Great Britain, Scandinavia, the Continent, S.A., India and the Far East. All roads have led to Chicago for this Show. Yes, even from behind the "iron curtain." The UN should have a delegation at the Show; here is a meeting of minds centering on one thing—better ways of doing that more people may enjoy the fruits of the machine. Let's only hope that some screwball doesn't turn the fruit into "grapes of wrath."

Well, I see that I'm getting pretty close to the final period, so I'll have to taper off. Our art director, Nic Varkula, had designed a new title block for the Column a/c now that I'm all repepped and rejuvenated the old plate doesn't do me justice. Besides, we're going to set up in three columns, so as to be consistent with the rest of the departments. No radical changes, as we promised long ago; just steady improvement.

By the time that this gets to the readers we'll be getting ready to go to Boston for the Semi-Annual. And let me tell you that this is going to be a meeting you don't want to miss. The Bostonians have drawn organizing talent from all over New England, to augment the local manpower, in order that this will be a meeting of meetings. Don't let 'em down!

Speaking of Boston, I saw Art Nichols at the Show—but then, I think I've seen about everybody that could possibly get away. And they're still coming and everybody hoping they'll get a place to sleep. Which reminds me that it's 'way into the wee-wee hours and I've been pounding the old portable until my fingers are numb. With that, good night—and sleep tight.

ASTEely Yours,

Andy

BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

Mounted Wheels, published by **THE ARBORUNDUM CO.**, Niagara Falls, N. Y., is a 32-page handbook on the use of mounted wheels—and related abrasive products — with light portable grinding equipment.

DIAMOND MACHINE TOOL CO., 2429 E. Olympic Blvd., Los Angeles 23, announces a 4-page folder on the new *Diamond Bench Mill* and accessories.

Better Broach It is a unique brochure issued by **THE CONNECTICUT BROACH AND MACHINE CO.** of New London, Conn. Following an introductory story of the company and its products are 10 four-page Case Studies of actual Broaching operations. In addition there are 12 pages of general information on Broaching and inside the back cover a 12-page book of the latest engineering data of Broaching Standards.

WALSH PRESS & DIE CO., 4709 W. Kinzie St., Chicago 44, has described its new press line in a 6-page bulletin, *Walsh Presses*. Ten models of open-back, inclinable punch presses, capacities of 6 to 90 tons, are shown. The presses feature the Walsh Power Press Safety Device which is said to eliminate the need for skilled operators.

Bulletin 67110, by **THE OILGEAR COMPANY**, 1364 W. Bruce St., Milwaukee 4, Wisc., describes the new line of small Fluid-Power, Variable-Speed Transmissions, up to 3 HP. The transmissions feature input speeds up to 1750 RPM, with output variable from 0 to 1600 RPM in either direction. Four styles of manual, hydraulic, and hydro-electric control devices are available.

SHELL OIL COMPANY, 50 W. 50th St., New York 20, has presented a simple yet comprehensive review of hydraulic principles and problems in a well-illustrated, 44-page booklet, *Hydraulic Equipment*.

Chambersburg Steel Side Trimming Presses are described and illustrated in a new bulletin issued by **CHAMBERSBURG ENGINEERING CO.**, Chambersburg, Pa. Design of press is claimed to prevent damage when press is stalled through overload.

A 32-page pocket manual on *Grinding "Haynes Stellite" J-Metal and "2400" Cutting Tools* is available from **NORTON COMPANY**, Worcester, Mass. *Norton Mounted Wheels and Mounted Points* is a complete directory of Norton products in this classification.

AMGEARS, INC., 6633 W. 65th St., Chicago 38, has a folder illustrating its line of *Amtec Spline Arbors*, which are available for a wide variety of applications.

THE VULCAN TOOL CO., 730 Lorain Ave., Dayton 10, Ohio, recently issued a folder, *Vulcan Equipment List*, which includes a complete floor layout of their toolroom and a list of all equipment available to meet special needs of Vulcan customers. *The Vulcanaire* describes a quick-change unit which will convert a wide variety of Machine Tools into high speed precision grinders. *The Fable of the Silkworm and the Toolmaker* is an inspiring short story that every engineer should read.

The Industry Div'n, **BUREAU OF THE CENSUS**, Washington, D. C., has issued a 14-page recapitulation of *Machine Tools for 1946*. A number of charts, elaborated on in the text, show values and number of shipments made by manufacturers of machine tools in various classifications.

The **GRINDING WHEEL MANUFACTURERS ASS'N**, 27 Elm St., Worcester 8, Mass., is to be commended for its preparation of *Portable Grinding Wheels—Safe and Efficient Operation*, which shows both correct and incorrect methods employed in grinding.

F. & F. MOLD & DIE WORKS, 103 Sachs St., Dayton 3, Ohio, has shown in a 4-page folder some typical injection-molded plastic products engineered and molded by them. The same facilities and trained personnel are available to other companies.

The Plastics Div'n, **AMERICAN CYANAMID CO.**, 30 Rockefeller Plaza, New York 20, has published *Laminac Laminating Resins*. Applications already in production as well as potential uses are illustrated and described.

The **STANDARD ELECTRICAL TOOL CO.**, 2499 River Road, Cincinnati 4, Ohio, has announced a 16-page *Catalog B-10* illustrating its heavy duty and extra heavy duty buffing and polishing machines and infinitely variable speed buffing and polishing machines.

PRATT & WHITNEY, Div'n of Niles-Bement-Pond Company, West Hartford 1, Conn., has announced a 36-page catalog on *Keller Burs and Accessories*, supplementing the *Kellerflex Machine Catalog*, which has been in use for some time. Together, these two catalogs cover the complete flexible shaft line.

NEW BRITAIN-GRIDLEY MACHINE DIV'N, The New Britain Machine Co., New Britain, Conn., has announced a 12-page booklet on the New Britain *4-Spindle Automatic Chucking Machines*, Models 475, 49, and 412. New Britain *Contour Boring and Turning Machines* is a 6-page bulletin, giving details of design and operation, and major specifications.

HANNA ENGINEERING WORKS, 1765 Elston Ave., Chicago 22, has issued a new bulletin on *Hanna Valves*, giving specifications and general information on the Hanna line of foot-operated and hand-operated valves for air and hydraulic lines, and special control valves for use with air and hydraulic cylinders.

OAKITE PRODUCTS, INC., 157 Thames St., New York 6, recently released a special service report on *Improved Pickling and Neutralizing*, showing how Oakite products promote economy and high quality in this field.

ROCKFORD MAGNETIC PRODUCTS CO., INC., Rockford, Ill., is distributing a bulletin on the new *Power-Grip Hand Separator*, designed for separating steel pieces from non-magnetic materials.

WESTINGHOUSE ELECTRIC CORP., P. O. Box 868, Pittsburgh 30, Pa., has announced a 36-page booklet on *Rototrol*, for automatic operation of industrial electrical equipment. These simple but highly efficient units can regulate voltage and current, control speed of DC motors, maintian constant tension or torque, limit loads on equipment, or they can perform any of many other difficult tasks which have been obstacles to fully automatic production.

PROGRESSIVE WELDER CO., 3050 E. Outer Drive, Detroit 12, offers description and valuable application data on its press type spot and projection welders in *Bulletin 603*.

FACTORY SERVICE CO., 4615 N. 21st St., Milwaukee 9, Wisc., presents many new ideas on effiicient storing and moving of materials in *The Turner System of Materials Handling*.

McGILL MANUFACTURING CO., INC., Valparaiso, Ind., announces that *Bulletin CY-47* offers engineering and application data on its Cam Yoke Roller Bearing, the latest development in McGill Multirol roller bearing design.

The **HPL MANUFACTURING CO.**, Cleveland, Ohio, has issued a bulletin on the new anti-corrosive *HPL Strip Expander*, for leather cup packings, on pneumatic or hydraulic equipment. The expander is designed so that the outward pressure is sufficient only to maintain constant contact between packing seal lip and cylinder wall, thereby assuring a perfect seal.

REYNOLDS METAL CO., 2500 S. Third St., Louisville 1, Ky., has prepared a 12-page brochure offering a wealth of ideas for manufacturers of lighting fixtures. It is available from Reynolds Metals Co., or from **GENERAL ELECTRIC CO.**, Nela Park, Cleveland 12.

Directory of A.S.T.E. Chapter Chairmen

AKRON, NO. 47
Second Thursday *
Herman A. Guy, *Chairman*
R. D. No. 1, Alliance, Ohio

ATLANTA, NO. 61
Third Monday *
Dwight L. Hollowell, *Chairman*
3174 Peachtree Dr., N. E.,
Atlanta 5, Ga.

BALTIMORE, NO. 13
First Wednesday *
Thomas F. Burke, *Chairman*
2802 Kennedy Ave.,
Baltimore 18, Md.

BINGHAMTON, NO. 35
1st Wed. after 1st Mon. *
Roland B. Andrews, *Chairman*
461 Vestal Road, R. D. 2,
Binghamton, N. Y.

BOSTON, NO. 33
Second Thursday *
John Ryneska, *Chairman*
Western Ave. 69-A,
E. Lynn, Mass.

BUFFALO-NIAGARA FRONTIER, NO. 10
Second Wednesday *
Albert Kirchgessner, *Chairman*
127 Columbia Drive,
Williamsville, N. Y.

CEDAR RAPIDS, NO. 71
Third Wednesday *
Robert A. Hruska, *Chairman*
2011 D Ave., N. E.,
Cedar Rapids, Iowa

CENTRAL PENNSYLVANIA, NO. 22
Second Tuesday *
Paul P. Stock, *Chairman*
460 Edgehill Rd., York, Penn.

CHICAGO, NO. 5
First Monday *
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2727 So. Troy St.,
Chicago 23, Ill.

CINCINNATI, NO. 21
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George R. Squibb, *Chairman*
R.R. No. 1, Box 143-K,
Cincinnati 27, Ohio

CLEVELAND, NO. 3
Second Friday *
Edgar W. Baumgardner, *Chairman*
13825 Triskett Road,
Cleveland 11, Ohio

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Walter E. L. Bock, *Chairman*
323 Southwood Ave.,
Columbus, Ohio

DAYTON, NO. 18
Second Monday *
Edgar J. Seifreat, *Chairman*
P.O. Box 332, Dayton 1, Ohio

DECATUR, NO. 58
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Ray W. Howell, *Chairman*
1476 W. Decatur, Decatur, Ill.

DENVER, NO. 77
First Wednesday *
B. J. Hazewinkel, *Chairman*
2355 Jasmine St.,
Denver 7, Colo.

DETROIT, NO. 1
Second Thursday *
Leslie B. Bellamy, *Chairman*
220 E. Milwaukee Ave.,
Detroit 2, Mich.

ELMIRA, NO. 24
First Monday *
Edward Stachel, *Chairman*
927 Spruce St., Elmira, N. Y.

ERIE, NO. 62
First Tuesday *
Mathew H. Hetzel, *Chairman*
1140 West 31st St., Erie, Pa.

EVANSVILLE, NO. 73
Second Monday *
Frank J. Hausfeld, Jr., *Chairman*
R.R. No. 5, Box 30,
Evansville, Ind.

FAIRFIELD CTY., NO. 6
First Wednesday *
Arthur R. Hunt, *Chairman*
64 Avon St., Devon 2, Conn.

FLINT, NO. 68
Third Thursday *
Norman F. Snyder, *Chairman*
2006 Mt. Elliott, Flint 4, Mich.

FOND DU LAC, NO. 45
Second Friday *
William E. Rutz, *Chairman*
142 Dott St., Fond du Lac, Wis.

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John Horton, *Chairman*
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1421 N. Edgemont,
Los Angeles 27, Calif.

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John E. Paskey, *Chairman*
2322 Greenwood Ave.,
Louisville 11, Ky.

MADISON, NO. 75
1st Tues. after 1st Mon. *
Fred H. Kessenich, *Chairman*
308 E. Wilson St.,
Madison 3, Wis.

MID-HUDSON, NO. 74
Second Tuesday *
John L. Petz, *Chairman*
Pendell Road,
Poughkeepsie, N. Y.

MILWAUKEE, NO. 4
Second Thursday *
Paul E. Butzin, *Chairman*
8104 Richmond Court,
Wauwatosa 13, Wis.

MONTREAL, NO. 50
Second Wednesday *
Henry T. Welch, *Chairman*
732 Victoria Ave.,
St. Lambert, Que.

MUNCIE, NO. 70
Second Wednesday *
Robert L. Waters, *Chairman*
811 March St., Muncie, Ind.

NASHVILLE, NO. 43
Third Friday *
C. L. McCaffrey, *1st V-Chm.*
1513 Ashwood Ave.
Nashville 4, Tenn.

NEW HAVEN, NO. 41
Second Thursday *
Ray E. Gifford, *Chairman*
96 Kimberly Ave.,
East Haven 12, Conn.

NEW ORLEANS, NO. 60
Second Wednesday *
Carl Hazlewood, *Chairman*
6574 General Haig
New Orleans 19, La.

NEW YORK, GREATER, NO. 34
First Monday *
Harmon S. Hunt, *Chairman*
325 Cherry St.,
Douglaston Manor, L.I., N.Y.

NIAGARA DISTRICT, NO. 65
Second Friday *
William L. Sandham, *Chairman*
94 Dunlop Drive,
St. Catharines, Ont.

NORTH TEXAS, NO. 51
2nd Friday *
Theodore A. Hersh, *Chairman*
2901 Westridge Ave.
Ft. Worth 7, Texas

NORTHERN NEW JERSEY, NO. 14
Second Tuesday *
Charles Carlson, *Chairman*
Thomas A. Edison, Inc.
Orange, N. J.

PEORIA, NO. 31
First Tuesday *
R. C. Kolb, *Chairman*
98 N. Maplewood Ave.,
Peoria 5, Ill.

PHILADELPHIA, NO. 15
Third Thursday *
Arthur R. Diamond, *Chairman*
Greene Manor,
Johnson and Greene Sts.,
Philadelphia 44, Pa.

PHOENIX, NO. 67
Third Wednesday *
Harry E. Rivers, *Chairman*
Rt. No. 1, Box 43-D
Tempe, Arizona

PITTSBURGH, NO. 8
First Friday *
Paul H. Magnus, *Chairman*
Tranter Mfg. Co.,
105 Water St.,
Pittsburgh 22, Pa.

PONTIAC, NO. 69
Third Thursday *
Albert J. Rhodes, *Chairman*
1245 Rhodes Rd.
Lake Orion, Mich.

PORTLAND (MAINE), NO. 46
Fourth Friday *
Carl L. Bohlin, *Chairman*
28 Hall Ave., Saco, Maine

PORTLAND (OREGON), NO. 63
Third Thursday *
William E. Brennan, *Chairman*
3036 S.E. 33rd Ave.,
Portland 2, Ore.

POTOMAC, NO. 48
First Thursday *
Richard P. Thayer, *Chairman*
4704 Butterworth Pl., N.W.
Washington 16, D. C.

RACINE, NO. 2
First Monday *
William P. Clark, *Chairman*
2105 Washington Ave.,
Racine, Wis.

RICHMOND, NO. 66
Second Tuesday *
Lowell B. Penland, *Chairman*
2509 E. Main St.,
Richmond, Ind.

ROCHESTER, NO. 16
First Monday *
Milton L. Roessel, *Chairman*
97 Biltmore Drive
Rochester 12, N. Y.

ROCKFORD, NO. 12
First Thursday *
Earnest Y. Seborg, *Chairman*
1523 Huffman Blvd.,
Rockford, Ill.

ST. LOUIS, NO. 17
First Thursday *
Edward H. Ruder, *Chairman*
57 Hanley Downs,
Richmond Heights 17, M

SAN DIEGO, NO. 44
Second Tuesday *
Raymond W. Peters, *Chairman*
6952 Fitch Ct.
San Diego 11, Calif.

SCHENECTADY, NO. 20
Second Thursday *
John Stedman, *Chairman*
54 Broderick St.
Albany 5, N. Y.

SEATTLE, NO. 39
Second Tuesday *
Gordon Munro, *Chairman*
Rt. 4, Box 2432
Bremerton, Wash.

SOUTH BEND, NO. 30
Second Tuesday *
Edgar W. Helm, *Chairman*
1152 E. Victoria St.,
South Bend 14, Ind.

SPRINGFIELD (ILLINOIS), NO. 64
First Tuesday *
Henry G. Becker, *Chairman*
830 No. 5th St.,
Springfield, Ill.

SPRINGFIELD (MASS.), NO. 32
Second Monday *
Alexander W. Todd, *Chairman*
50 Johnson St.,
Springfield 8, Mass.

SPRINGFIELD (OHIO), NO. 76
First Monday *
James B. Douglas, *Chairman*
609 E. McCreight,
Springfield, Ohio

SYRACUSE, NO. 19
Second Tuesday *
Hugo C. Klix, *Chairman*
425 Glenwood Ave.,
Syracuse 7, N. Y.

TOLEDO, NO. 9
Second Wednesday *
Albert Hage, *Chairman*
3700 Roanoke Rd.,
Toledo 12, Ohio

TORONTO, NO. 26
First Wednesday *
L. M. Jardine, *Chairman*
6 Pepler Ave., Toronto, Ont.

TRI CITIES, NO. 23
Third Monday *
Lennart N. Dahlen, *Chairman*
901 43rd St.
Rock Island, Ill.

TWIN CITIES, NO. 11
First Wednesday *
Clifford V. Lofdahl, *Chairman*
5933 Elliott Ave. S.,
Minneapolis 7, Minn.

TWIN STATES, NO. 40
Second Wednesday *
Alan E. Stubbs, *Chairman*
Highland Rd., Springfield, Vt.

WESTERN MICHIGAN, NO. 38
Second Monday *
Peter C. Maghielse, *Chairman*
2434 Miller Ave., N. W.
Grand Rapids 4, Mich.

WICHITA, NO. 52
Second Wednesday *
Harold J. Bales, *Chairman*
1702 N. Lorraine Ave.,
Wichita 6, Kan.

WILLIAMSPORT, NO. 49
Second Monday *
Lewis H. Bardo, *Chairman*
2347 Hillside Ave.,
Williamsport, Penn.

WINDSOR, NO. 55
Second Monday *
R. T. Richards, *Chairman*
R.R. No. 1, Windsor, Ont.

WORCESTER, NO. 25
First Tuesday *
Charles W. Monigle, *Chairman*
364 Greenwood St., R.F.D. 2,
Millbury, Mass.

* CHAPTER MEETING NIGHT

Banquet Testimonial to Honor Burt

Niles-Bement-Pond Head Guest Speaker at Boston

WHEN THE Society gathers for its Semi-Annual Dinner, November 1, in Hotel Statler, Boston, it will pay tribute to one of its most distinguished members. For Clayton R. Burt, Chairman of the Board of Directors, Niles-Bement-Pond Co., West Hartford, Conn., is known throughout the machine tool industry, a field he has served for more than half a century.



C. R. Burt

As guest speaker at the banquet, Mr. Burt will relate his impressions of "A Lifetime of Progress in Tool Engineering," spanning the 55 years since his apprenticeship at Brown & Sharpe Mfg. Co., on through executive and administrative posts with several companies.

A member of Hartford Chapter, ASTE, he has always been interested in the Society's welfare and progress. "Men Who Make Dreams Come True," the theme of the ASTE 1946 New Era Exposition, was inspired by an article appearing in one of his company's publications, extolling the praises of the production genius represented in ASTE.

On the festive side, the Host Chapter has arranged for an hour's entertainment by top flight professional talent and a name band to play throughout the dinner and for two hours of dancing after the banquet speaking program.

From the technical end, advance drafts of speakers' papers indicate that the Boston Semi-Annual Meeting will be jam-packed with scientific "know-how."

The General Electric Co. welding session, Thursday evening (October 30), will embrace flash-butt, spot, oxy-acetylene, and arc welding with slide illustrations of practical applications, as well as of fixtures, dies and special machinery. The keynoter, J. E. Anderson, Asst. to the Works Manager at the River Works, West Lynn, Mass., will be followed by D. W. Puffer, a welding engineer at the same plant, and E. H. Girardot, Foreman of Tool Design at the Schenectady works, who will collaborate in their presentation.

A highlight of the Friday afternoon Material Handling meeting will be the actual layouts with three-dimensional models which H. H. Dasey, President, Visual Production Planning, Inc., Pittsburgh, Pa., will show.

P. R. Minich, who will prescribe proper material handling in a model plant such as Mr. Dasey will show, had a thorough background in production planning before becoming District Manager of Rack Engineering Co. of Pittsburgh.

Another interesting exposition of material handling is promised in a discussion of the processing of webs and monofilaments by C. A. Litzler, President, Industrial Ovens, Inc., Cleveland, Ohio.

The specialized production of extreme precision ball bearings, developed from the making of super-precision bearings for the Norden bombsight, has been the result of accurate tooling and inspection methods as F. E. Ericson, Vice-President-General Manager of The Barden Corp., Danbury, Conn., will point out during the Friday evening session, "Bearing Applications."

Not content with lining up a plant tour schedule of proportions probably unequalled at Society meetings, the committee in charge of this activity has made another coup in arranging a visitation to the U. S. Naval Air Station.

There the former hush-hush radar ground controlled approach system for guiding airplanes to fogbound airports will be shown and explained. A new 10-ton tire changer for airliners will be seen in operation, in addition to a complete motor overhauling demonstration of test-



C. A. Litzler



J. E. Anderson



P. R. Minich



F. E. Ericson



D. W. Puffer



E. H. Girardot



TECHNICAL SPEAKERS

H. H. Dasey, setting up efficient plant layout with three-dimensional models

Left: Faneuil Hall market area is a mecca for connoisseurs of hearty New England food served without ostentation. Center: Boston skillfully combines the old and new as in this State Street banking house where equipment behind cages is most modern, while banking room is attractive museum of Early Americana. Right: This assembly line of double package makers shown in various stages of completion in the new extension of Pneumatic Scale Corp. plant at N. Quincy, Mass., will be ready for inspection by ASTE members in Society tour of plant during Boston convention









W. Hart Nichols
Co-Chairman
Accommodations



H. G. Senning
Co-Chairman
Plant Tours

ON CONVENTION COMMITTEE



H. L. Rich, Jr.
Co-Chairman
Film Arrangements



A. J. Snyder
Co-Chairman
Emergency

ing apparatus and a tour of the shops.

And the Navy's welcome includes ladies who wish to accompany their engineer husbands on this event.

Revisions and additions to room assignments for the various meetings and events scheduled during the three-day convention, are: Thursday, October 30—Education Committee, Parlor D; Ladies Reception Lounge, Hancock Room, Mezzanine; Honor Awards-Judicial Committee, location to be announced.

Friday, October 31—Ladies Reception Lounge, Parlor A, Mezzanine. Saturday, November 1—Public Relations Committee, Parlor D; Ladies Reception Lounge, Parlor A.

The registration desk will be maintained throughout the convention outside the Ballroom Foyer on the Mezzanine. Advance registrations, now being received from all sections, indicate a heavy attendance for the Society's 30th national meeting.

Members planning to attend the convention are urged to submit the registration forms mailed to them earlier. And October 15 is the deadline for guaranteed room assignments. Better get that hotel reservation form off to the Boston Convention Bureau today.

These Montreal members gather at Northern Electric Co. for tour of the huge communications equipment factory

Exhibit Space Increased for 1948 ASTE Exposition

Detroit, Mich.—An improved layout, showing approximately 25 percent increase in exhibit space for The Tool Engineer's Industrial Exposition, the Society's 1948 show in Cleveland Public Auditorium, March 15-19, was approved at a joint meeting, September 12-13, of the Exposition Committee and representatives of Brooke, Smith, French & Dorrance, Inc., the Society's advertising agency.

C. V. Briner, Chairman of the Exposition Committee, presided at the two-day conference.

Exhibit hours established are from 9:00 A.M. to 6:00 P.M. throughout the five days of the show. Registration will be conducted much the same as for the 1946 exposition, with the visitor's name and address information to be processed on the registration form before it is mailed to him. A registration fee of $1.00 was recommended.

A complete layout of promotional material and advertising schedules was presented by Bart Wilmot of Brooke, Smith, French & Dorrance and accepted with some revisions. The Committee also favored an attractive exhibit guide, containing a cross indexing of exhibitors, program of the Annual Meeting, and spaces for notes, in addition to pertinent data concerning the exhibits and exhibit hall.

Handling of housing accommodation applications was discussed. The release of government occupied hotels in the Cleveland area is expected to permit more visitors and exhibitors to be housed during the big showing of production equipment.

Other members of the Committee attending the meeting included Past Presidents A. M. Sargent and Ray H. Morris, and Leslie F. Hawes, Los Angeles Chapter Chairman. Also present were H. E. Conrad, Executive Secretary; C. J. Hasse, Office Manager; J. M. Cannon, Public Relations Director; H. M. Windsor, Secretary to the National Program Committee; C. Vortman and Robert Edwards of the advertising agency; and Joseph V. Friel of Reber-Friel Co., Operating Show Manager.

Communications Equipment Plant Shows Elaborate Tooling

Montreal, Que.—The involved tooling and extensive machinery required to manufacture communications equipment were a revelation to Montreal Chapter members who were recent visitors at the block-square, eight-floor plant of Northern Electric Co., Ltd.

Although the huge building which houses the telephone, electronics and cable divisions is too large for complete inspection during an evening, the tour was so well organized that the engineers could readily follow the various stages of manufacture from raw material to finished product.

Escorted in small parties by company guides, the 75 visitors were first taken to the telephone division to see the many intricate parts comprising an ordinary desk or wall set. The complex tooling for fabricating these parts necessitates a force of 200 toolmakers.

The tool room, equipped with machinery rarely seen in Canada, commanded unusual interest. Here the members had opportunity to watch operations on optical and precision contour grinders, induction heating equipment, a great variety of high precision jig borers and duplicating machines, and a liquid honing machine which polishes and hones dies, molds and other tools requiring a high degree of surface finish.

Press tools, such as multi-station, progressive, and cut and carry dies, automatic feeds and ejectors, and mirror-finished plastic molds also held the tool engineers' attention.

In the assembly department they noted the wide use made of conveyors and moving belts, that the principles of time and motion study had been effectively applied.

High speed wire drawing, stranding, twisting, covering, insulating and reinforcing of cables were followed intently in the cable division which processes fine filament wire thinner than a human hair to huge armour plated submarine cables for trans-oceanic communication.

The production of radios, tubes, and Hammond electric organs was shown and explained in the electronics division. Automatic machines, making vacuum tubes, heat glass to a plastic state, form, flare, cut off and weld it to mating parts and reject defects at an amazing speed.

Another highlight of the tour was the enormous automatic electro-plating plant where steel parts were being cadmium plated. The parts are loaded to an overhead conveyor and mechanically passed through degreasing, pre-treatment, plating, rinsing and drying stages.

At the conclusion of the tour, a buffet supper was served in the plant cafeteria.



British Industrial Press Spreads Linsley's Gospel Of the Machine Tool as a Creator of Employment

Wolverhampton, England—Importance of the message which H. E. Linsley, then Machine Tool Editor of *The Iron Age*, and ASTE National Program Committeeman, brought to the Institution of Production Engineers as guest speaker at a meeting held July 19 is apparent in the prominence and space devoted to reports and editorial comments on the occasion by the British industrial press.

As reported in the August *ASTE News*, Mr. Linsley, who has since become associated with *American Machinist*, was returning the visit of E. W. Hancock, Past President of the Wolverhampton Section, IPE. Mr. Hancock presented an Honorary Membership in his organization to the ASTE President at the Society's 1946 Annual Meeting.

The Times Review of Industry, commenting on a greeting which Mr. Linsley conveyed for ASTE President W. B. Peirce, says:

> . . . In this message Mr. Peirce pleads for closer and better cooperation between the two organizations in question, and by extending the use and privilege of all the facilities of the American Society of Tool Engineers to the British Institution of Production Engineers expresses the good will he conveys in a practical form which will be welcomed by all production engineers in this country.

Aircraft Production, considering Mr. Peirce's statement: ". . . in America there is hardly such a thing as a secret process in industry . . .," remarks:

> . . . We may regard this as an idealized picture of the true position, but it is good to state ideals as often as possible . . . no one organization has a monopoly of brainpower and exclusiveness can only lead to overlapping of effort and retardation of the tempo of progress.
>
> So often a new development is treated as an ultimate achievement instead of being regarded as merely another stage in a continuing evolution. Very few seem to have the courage which should be the natural result of experience and leadership in knowledge—the realization that he who leads is in front, just as he who copies (and who therefore follows, however closely) is inevitably behind.

An editorial in *The Machinist*, based on Mr. Linsley's paper citing the case that mechanization spreads employment, observes:

> . . . In the critical situation facing us in this country to-day, it is no exaggeration to say that the increased productivity which would result from the wider acceptance of this doctrine is essential to our salvation . . . Many of his (Mr. Linsley's) hearers were already well aware of its significance. But for every person in this country who has accepted the principle as an article of faith, there are thousands who make it clear by their actions that they are still unconverted.
>
> . . . The reason is not far to seek. There has continually been under- and un-employment. Widespread at times, and still appreciable to-day, it is always threatening. But this is no fault of the machine. It in no way impairs the validity of the doctrine that machines create wealth *and* employment.
>
> On the other hand, it does most emphatically demonstrate that machines and technological development alone will not produce wealth. It shows, too, that they can gravely aggravate the incidence of unemployment unless they are rationally applied, and all the other inter-related economic and political factors involved permit a full and unfettered exchange of the products of the machine, on a national and international scale.
>
> There can be no doubt that the machine, as a means of making the fruits of man's genius in invention readily available to all, can provide for a fullness of life and a degree of comfort in living beyond our powers of conception. It still remains for us to prove that we are its master.

Mechanical World and *The Machinery Market* carried abstracts of Mr. Linsley's address, "The Machine Tool and You." Both *Machinery* and *The Machinist* published full accounts of the IPE meeting, including advance photographs of Chicago Machine Tool Show exhibits, shown by Mr. Linsley in lantern slides.

Other trade papers reporting the internationally-significant meeting included *Engineering* and *Machinery Lloyd*.

At the conclusion of the afternoon business session held in Wulfrun Hall, tea was served, followed by a concert in the Civic Hall, arranged by the Mayor of Wolverhampton.

In the evening a "Goodwill Dinner," honoring Mr. Linsley, was held at the Royal Star and Garter Hotel. The Mayor of Wolverhampton (Alderman C. B. E. Taylor) extended a civic welcome. Other messages of goodwill were conveyed to the guest of honor by F. Glover, Section President, Melbourne, Australia; Lord Sempill, a former Wolverhampton Section President; and Mr. Hancock.

Cornelius J. Dwyer of the American Embassy spoke briefly as the representative of the American Ambassador.

Mr. Hancock, who introduced Mr. Linsley at the earlier technical meeting, made a plea for better understanding between British and American engineers, suggesting a regular interchange of graduates of the two organizations. Another idea presented by Mr. Hancock was the linking of the two societies in Canada where ASTE has nearly 1000 members.

Important institutions, such as those represented at the meeting, he stressed, could provide common ground and appropriate opportunities for the cooperation among the ordinary people of the world that is so essential for peace and progress.

After endorsing Mr. Hancock's suggestions and expressing the hope that they might materialize, Mr. Linsley presented a framed, illuminated copy of the ASTE Code of Ethics to Lord Sempill.

Mr. Linsley, in turn, was the recipient of a silver cigarette box presented by Mr. Tompkiss, Chairman of the Graduates Section of IPE, as a personal momento of the occasion.





Left: H. E. Linsley, ASTE Program Committeeman, presents illuminated copy of ASTE Code of Ethics to Lord Semphill (right), Past President of IPE. Below: Wolverhampton Production Engineers, their guests and municipal dignitaries tender "Goodwill" dinner to Mr. Linsley at the Royal Star and Garter Hotel. Right: Mr. Tompkiss, Chairman of Graduates Section, IPE, gives Mr. and Mrs. Linsley silver cigarette box as a personal memento.





Only Benjamin Franklin in his stone cape remains cool during sweltering September evening of Philadelphia Chapter's Annual Executives Dinner. Inset, top: Dr. James Creese, President of Drexel Institute of Technology, pleads for cooperation between science and industry. Below: Arthur Diamond, Chapter Chairman, acts as toastmaster for function

Industrialists Told Benefits of Cooperating with Science

Philadelphia, Pa.—There is pressing need for an alliance and a new kind of working arrangement between industry and institutions of higher learning, Dr. James Creese, President of Drexel Institute of Technology, said in an address before Philadelphia Chapter members and guests at the Chapter's annual Executives and Educators Dinner in Franklin Institute. His subject was "The Common Ground of Scholarship and Industry."

Dr. Creese referred to plans for "operational research," advanced recently by British scientists, as indicating that the team work of industrial engineers and academic scientists on radar and penicillin will be continued for the solution of industrial and economic problems on a large scale.

He mentioned the competition existing between industry and education in recruiting research scientists and warned of a dearth of university teachers to train industrial specialists of the future.

The dinner speaker, Harry E. Conrad, ASTE Executive Secretary, reported on the past, present and future activities of the Society. Tool engineering knowledge, he said, is being brought to college students through courses and lectures. Other Society-sponsored educational projects include the publication of textbooks on tool design and a tool engineer's handbook, he added.

The new ASTE standardization program and the Society's public relations work in acquainting industry with the tool engineer's role and in stimulating interest in more effective technical education for tool engineers were also emphasized.

In conclusion, Mr. Conrad appealed for industry's support in the organization's efforts to supply it with better trained technicians.

J. A. Brooks, Jr., Chapter Education Chairman, reviewed the Chapter's educational accomplishments in sponsoring tool and die design courses at Spring Garden Institute. A new lecture series on specialized subjects to augment the curricula and discussions of tool engineering problems to be conducted at local colleges are also planned, he announced.

Arthur Diamond, Chapter Chairman, was toastmaster for the function attended by approximately 300 engineers, industrialists and educators.

Guests also included T. B. Burke, Baltimore; P. R. Stock, York, Pa.; H. S. Hunt, New York; R. P. Thayer, Washington; and L. H. Bardo, Williamsport, Chairmen of their respective Chapters.

Fellow Members Fete Schmit

Toledo, Ohio—A testimonial dinner honoring A. M. Schmit, retiring ASTE Director, was sponsored by Toledo Chapter, September 10, in the Secor Hotel.

Mr. Schmit, General Manager of A. M. Schmit Co., Toledo, has served in various national capacities during the ten years of his affiliation with the Society. In addition to three terms as National Director and one as National Secretary, he has been a member of the Finance, Time and Place, Nominating, and National Editorial Committees.

In recognition of his outstanding service, W. B. Peirce, Society President, presented a merit award plaque to Mr. Schmit on behalf of the Chapter.

Advances in Steel Making Assure Uniform Quality

Grand Rapids, Mich.—Western Michigan Chapter members exhibited lively interest in recent developments in high speed steels as related by Dr. S. G. Fletcher, Chief Metallurgist of the Latrobe Electric Steel Co.

Dr. Fletcher was guest speaker at the Chapter's first meeting of the season, held September 8 in the Rowe Hotel.

Using diagrams and pictures, the speaker showed the characteristics of general types of high speed steels and the kind of work for which each is best suited.

Advances in high speed steel manufacture, he pointed out, have added positive quality control through elimination of segregation in any part of the steel billet.

R. P. Kells, Chief Service Engineer of Latrobe, conducted the ensuing discussion period. Mr. Rath of the company's Detroit office also was a guest at the dinner meeting.

Prior to the technical session colored motion pictures were shown of an exploration up the inner passage of Alaska and of hunting for blue geese in the Louisiana marshes.

Optical Projection Claimed Most Efficient Inspection

Boston, Mass.—Harold Murch, Chief Optical Engineer of Jones & Lamson Machine Co., Springfield, Vt., gave an enlightening lecture on "Modern Methods of Inspection by Optical Projection" at a recent Boston Chapter meeting.

Inspection by a one-piece projection unit called a Comparator is the easiest, fastest and most accurate method of checking screw threads, the speaker stressed.

The part being inspected, Mr. Murch added, may be projected at any desired magnification from 10X to 200X. The glass screen on which the test piece is projected may be charted with the various screw thread elements. These can all be checked easily and quickly as the projected image is compared with the chart. Form tools and irregular shaped parts also may be inspected with equal facility as any variety of master screens can be made, he pointed out.

In the discussion period following the lecture, Mr. Murch was plied with many questions by his audience.

William Fitzgerald, Supervising Safety Engineer, Globe Indemnity Insurance Co., Boston, demonstrated, by means of a psychophysical tester and an emotional stability tester, with several members acting as "guinea pigs," that the odds are against the pedestrian crossing the street, since it takes the average driver approximately one-half second of thought processes before he starts to apply the brakes.

Prior to the meeting, many members had the privilege of inspecting the new plant of H. K. Porter, Inc., and the Porter Forge & Furnace, Inc., at Somerville.

Claims Vibration Energy Awaits Man's Harnessing

Peoria, Ill.—All life is a series of impacts wrought by vibrations, whether of heat, light, sound, electricity, or human thought, according to Dr. Hilton Ira Jones, veteran chemist and psychologist.

In an address before 125 Peoria Chapter members and their guests at a dinner meeting September 2 in the Jefferson Hotel, Dr. Jones, reasoning that the energy created by these vibrations should be interchangeable, claimed that sound, light or human thought might some day run an automobile.

He thinks that Steinmetz was right when he said: "Some day we'll take the sunlight and convert it to electricity and with it run all the machinery in the world." And dynamos and boilers which convert raw materials to energy will be obsolete before too long, in the speaker's opinion.

Getting our energy from "middlemen" instead of directly leads Dr. Jones to think that future eras will look upon the "modern scientific age" with scorn. "Everything is here now, for the solving; the trouble is we haven't gotten hold of the right end of the string," he asserts.

Variations in the frequency of vibrations have tremendous effects on humans, Dr. Jones contends, explaining that long waves make a man sleepy, lower his blood pressure, while high frequency radiation raises blood pressure and the tendency to infection.

Unless we learn to manage these "dynamics which run our physical world," by control of the vibration rate, we'll impress future generations as old fogies, declares the eminent scientist who heads the Hizone Research Laboratories at Wilmette.



A. M. Sargent (right), the Society's immediate Past President, shows his pleasure in testimonial scroll presented by Leslie Bellamy, Detroit Chapter Chairman, as Chester Ricker (left) of *American Machinist* looks on

Home Chapter Honors Former President

Detroit, Mich.—During a recent meeting of Detroit Chapter, Chairman Leslie Bellamy presented a hand lettered scroll, on behalf of the Chapter, to A. M. Sargent, immediate Past President, in appreciation of his pioneering efforts for the Society and his sustained personal interest throughout the 15 years of its existence.

In accepting the scroll, Mr. Sargent expressed his thanks and pleasure with sincerity and feeling.

Standardization Program Offers Members Opportunity To Acquire Latest 'Know-How" in Chosen Fields

Opportunity to increase his own technical knowledge of a desired subject, while advancing the work of the Society, is afforded every member of ASTE in the new standardization program which the Society's National Standards Committee is launching.

All effort expended in the various projects will become a permanent contribution in the field of standardization, as all ASTE committees so engaged will be represented on American Standards Association committees, already existing or yet to be formed.

Chapter Standards Committees may select as many subjects as they wish, but it is not necessary to be affiliated with an ASTE Chapter Standards Committee in order to take part in this activity. Nor should any ASTE member, feeling unqualified, hesitate to serve in such capacity, as through these projects the Society will broaden the scientific knowledge of the membership.

Because of the wide geographical spread of our Chapters, much of the work will be carried on by correspondence, a method which has proved very successful in other nationally-known engineering societies.

Thirty-eight ASA projects, handled by sectional committees, are listed at the right. In the coupon below, check the numerical identification of the ones, or one, on which you would be willing to help. Then, in the space provided, jot down other suggested subjects for standardization. The most popular subjects, as determined by this survey, will be proposed to ASA for initiation into their procedure, under ASTE sponsorship.

Be sure to fill in your name, address and other factual data before mailing the coupon to W. H. Smila, Chairman, National Standards Committee, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

MECHANICAL ENGINEERING

- B4 Allowances and Tolerances for Cylindrical Parts and Limit Gages
- B3 Ball and Roller Bearings
- B18 Bolt, Nut and Rivet Proportions
- B46 Classification and Designation of Surface Qualities
- B52 Classification of Materials for Tools, Fixtures and Gages
- B19 Compressed Air Machinery and Equipment, Safety Code for
- B20 Conveyors and Conveying Machinery, Safety Code for
- B30 Cranes, Derricks and Hoists, Safety Code
- B36 Dimensions and Material of Wrought Iron and Wrought Steel Pipe and Tubing, Standardization of the
- B24 Forging and Hot Metal Forming, Safety Code for
- B6 Gears, Standardization of
- B33 Hose Coupling Screw Threads
- B13 Logging and Sawmill Safety Code
- B15 Mechanical Power-Transmission Apparatus, Safety Code for
- B9 Mechanical Refrigeration, Safety Code for
- B16 Pipe Flanges and Fittings
- B2 Pipe Thread
- B27 Plain and Lock Washers
- B11 Power Presses and Foot and Hand Presses, Safety Code for
- B40 Pressure and Vacuum Gages, Specifications
- B31 Pressure Piping, Code for
- B8 Protection of Industrial Workers in Foundries, Safety Code for the
- B38 Refrigerators, Specifications for
- B28 Rubber Machinery, Safety Code for
- B1 Screw Threads, Standardization and Unification of
- B49 Shaft Couplings, Integrally Forged Flange Type for Hydro-Electric Units
- B17 Shafting, Standardization of
- B5 Small Tools and Machine Tool Elements, Standards for
- B29 Transmission Chains and Sprockets
- B50 Unification of Rules for the Dimensioning of Furnaces for Burning Solid Fuel
- B7 Use, Care and Protection of Abrasive Wheels, Safety Code for the
- B32 Wire and Sheet Metal Gages

MISCELLANEOUS

- Z14 Drawings and Drafting Room Practice (Exclusive of Architectural Drawings), Standards for
- Z32 Graphical Symbols and Abbreviations for Use on Drawings
- Z15 Graphic Presentation, Standards for
- Z39 Library Work and Documentation, Standardization in the Field of
- Z17 Preferred Numbers
- Z53 Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment

OF COURSE I'LL HELP in the new ASTE standardization program. I'd like to assist in developing standards for (check designations corresponding to those listed opposite subjects above):

☐ B 1 ☐ B 2 ☐ B 3 ☐ B 4 ☐ B 5 ☐ B 6 ☐ B 7 ☐ B 8 ☐ B 9
☐ B 11 ☐ B 13 ☐ B 15 ☐ B 16 ☐ B 17 ☐ B 18 ☐ B 19 ☐ B 20 ☐ B 24
☐ B 27 ☐ B 28 ☐ B 29 ☐ B 30 ☐ B 31 ☐ B 32 ☐ B 33 ☐ B 36 ☐ B 38
☐ B 40 ☐ B 46 ☐ B 49 ☐ B 50 ☐ B 52 ☐ Z 14 ☐ Z 15 ☐ Z 17 ☐ Z 32
☐ Z 39 ☐ Z 53 I suggest as additional projects for standardization: .....

Signed .....
(Name)

Address ..... City ..... State .....
(Street) (Zone)

Chapter Name ..... Membership Grade .....

Mail to: W. H. Smila, Chairman, National Standards Committee, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Michigan

Tool Engineers' Handbook Authors
Biographical Briefs

A former editor of *Screw Machine Engineering*, **Lawrence C. Bates** now heads his own enterprise, Bates Industrial Publicity, at Rochester, N. Y.

His bent for writing developed through successive associations in production and promotion departments of Hardinge Brothers, Inc., at Elmira where he was educated and served on the engineering staff of the Pennsylvania Railroad.

In the Society, he chairmanned the Program Committee for Rochester Chapter throughout the 1945-47 seasons. He is also a member of ASM, SAE and AOA.

* * *

As a graduate electrical engineer of Iowa State College, **A. G. Baumgartner** entered the engineering department of General Electric Co. at Schenectady, N. Y., specializing in machinery.

Four years later he transferred to the Cincinnati plant to spend another nine years in the machinery field, before joining the Cincinnati Shaper Co. where he is now Asst. Sales Manager.

A member of the Engineering Society of Cincinnati, he is registered Professional Engineer in the State of Ohio.

* * *

After working as a youth in the family granite quarry, it was only natural that **E. Payson Blanchard** should become engaged in stone work architectural detail upon graduating from Brown University.

Then he entered the metal working field in tool and die designing for Osgood-Bradley Car Co., going on to Boston Pressed Metal Co. to eventually become Asst. to the General Manager. This led to his present connection with The Bullard Co., Bridgeport, Conn., where he is now Sales Manager and Director.

Like most busy men, he has found time for a number of extracurricular activities, such as industrial market research, and lecturing at several universities. His scientific affiliations include SAE, ASME, AIA, Brown Eng'g Asso., Natl. Aviation Asso., the American Academy of Political and Social Science, and the Natl. Industrial Advertisers Asso.

In the field of literature, he has collaborated in the writing of books on production control, business law and economics, and has contributed to technical publications.

* * *

Ever since **John Gaillard** won his degree of Doctor of Technical Science from the Institute of Technology at Delft, The Netherlands, for his thesis on industrial standardization, he has devoted himself to this field.

He held several industrial posts there before accepting the position of Asst. Director of the Central Standardization Bureau.

Coming to this country, he became associated with ASA in 1924. At present he is Secretary of the ASA Mechanical Standards Committee and the Committee on Preferred Numbers.

In addition, Dr. Gaillard serves as private consultant to industrial concerns with standardization problems. He is a member of ASME and the Society for the Advancement of Management.

* * *

Stuart P. Hall, who holds an assistant editorship on *Product Engineering*, garnered his industrial experience at General Motors Corp., where he first did brake research while still a student of Rensselaer Polytechnic Institute.

Following graduation, he became a student engineer in the Buick Motor Div. Through the war years he was a process engineer on tank drives and transmissions, subsequently becoming a production research engineer.

A. G. Baumgartner | H. L. Johnson | S. P. Hall | John Gaillard











L. C. Bates | E. P. Blanchard | William Kynoch | G. L. Kehl

During his association with Buick, he was an active charter member of Flint Chapter, ASTE, and served a term as Chairman of the Education Committee. He is also a member of Sigma Xi, Tau Beta Pi and Pi Tau Sigma fraternities.

* * *

Beginning with menial jobs in his father's shop in Minnesota, **Harold L. Johnson** progressed so slowly up the mechanical ladder that he decided to bolster his practical experience with an engineering course at the University of Wisconsin. After two years' study, the depression of the 30's forced him back into nondescript jobs while continuing his lessons through extension work.

Fortune began to smile again with a position as Inspector of Mechanical Equipment in the Wisconsin Highway Dept. Then a transfer was effected to a structural steel parts business.

A connection as Service Representative for Gisholt Machine Tool Co. of Madison, Wis., was followed by a position involving tooling and operation of a war plant for Barlow-Seelig Mfg. Co. of Ripon, Wis.

Early in 1945, he joined Giddings & Lewis Machine Tool Co. at Fond du Lac, Wis., where he affiliated with the local ASTE group.

* * *

When government representatives were searching for scientific talent in the development of the Los Alamos Atomic Bomb Project, they placed **Dr. George L. Kehl,** Asst. Professor of Metallurgy at Columbia University, in charge of the metallographic and heat treatment divisions.

Professor Kehl's activities at Columbia in teaching, research and consultation had a practical industrial background at the U. S. Steel Corp. Research Laboratories where he was concerned with problems in high temperature mechanical properties, creep and constant strain rate behavior, and the heat treatment and metallography of steel.

His findings have been recorded in a number of research papers dealing with the fatigue resistance of steel, X-ray diffraction and high temperature properties of steel. But he is probably best known for his text, "Principles of Metallographic Laboratory Practice." He is a member of AIME, ASM, SPEE and Sigma Xi.

* * *

Dr. William Kynoch, who heads the Wood Technology Dept. in the School of Forestry and Conservation at the University of Michigan, has made a career of research relating to wood.

His technical training was received at the University of Toronto and in England. For 13 years he was a member of the staff of Forest Products Laboratories of Canada.

Dr. Kynoch has contributed to the development of the incision process now extensively used in preservative treatment of ties and other timber. His present assignment includes extensive research on mechanical and related properties of certain tropical timbers, effect of fillers on properties of specific plastics and product development in plywood.

Vexing Engineering Problems Beset Chinese Industry

Williamsport, Pa.—The tool engineer China must not only adapt production the use of general all-round machines very short runs, but also anticipate ilizing such tools for larger output, and the same time operate all machines hand wherever possible.

But this is only one of the problems confronting industry in his country, Major K. Y. Loh, Chinese Air Force Liaison, Avco Mfg. Corp., Williamsport, told Williamsport Chapter members at a dinner meeting September 8 in Bair's Tourist Park.

Its primary tool engineering concern, he said, is threefold: to obtain good machine tools; to train operators for skilled work; and to secure sufficient high quality raw materials.

Size of machines, he added, is also an important consideration, as transportation facilities are somewhat limited.

Thomas Jester, Metallurgist for Darling Valve & Mfg. Co., spoke on case hardening of high speed steel. This process, which gained wide use during the war, can lengthen tool life from 100 percent to as much as 1000 percent when properly applied, said Mr. Jester.

Situations Wanted

CARBIDE TOOL ENGINEER specialist seeks position in this field or as process engineer. Has served as chief tool engineer and in machine tool sales. Thoroughly grounded in tool trouble, design, plant layout, process, and tool inspection, in addition to 12 years' work on all types of machines and two years of college engineering. Please reply to Box 126, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

EXECUTIVE ENGINEER, 37, with thorough background in management, engineering and manufacturing, in metal fabrication and mass assembly operations. Seasoned in production engineering, production control, welding engineering, plant engineering, industrial engineering, factory cost, purchasing and labor relations. Formerly with aircraft company, washing machine and iron manufacturer, and shipbuilder. Invites correspondence. Box 127, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

PRODUCTION MANAGER — Sales Engineer, 47. Experience includes: 17 years as mechanical engineer; 12 as chief engineer in charge of designing special high production machinery; 2 as master mechanic; 6 as general manager of plant machining precision aircraft and automatic parts; also several years as sales engineer for special machinery for automotive production. Salary, $10,000. Married; prefer Western states, but will consider other location. Details and references upon request. Please write Box 128, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

PRODUCTION SUPERVISOR, 47, with diversified experience in all phases of machine shop work, production scheduling, time study, tooling and tool design, desires responsible position with future. Married, willing to relocate. Will arrange interview at convenience of those interested. References. Please address reply to Box 125, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Says Soviets Rival United States with Forging Equipment

Baltimore, Md.—Russia has more modern forging facilities than any other nation, with the possible exception of the United States, according to R. E. W. Harrison, Vice-President and Chief Engineer of the Chambersburg Engineering Co., Chambersburg, Pa.

But the United States is about five times as advanced in such equipment as other competing countries, and we have led the world in research on modern methods, Mr. Harrison added, in an address on "Forming Metal Products by Impact," delivered September 3 before Baltimore Chapter members.

The speaker's observations were based on experiences in placing impact forging machinery in practically all parts of the industrial world.

Greater advances have been made in hot forging in the past 50 years than in the previous 2000, he pointed out, in tracing the history of metal forming by impact from prehistoric times. Mr. Harrison described various methods which have been used to increase the grain quality and structure of steel by impact forging, and applications of modern forging machines in war and peace.

Present methods, he emphasized, permit forging to such close limits that the parts can be taken directly from the forge shop to the grinder shop without any intermediate turning or milling.

During World War II, the speaker served as a Naval Commander, acting as a special assistant to the Under-Secretary, in his last tour of duty.

Sports Enthusiasts Have Workout at Boston Chapter Outing



Left: Arthur Nichols, of the National Program Committee, gives a preview of his "Boston Tea Party" costume acquired in Texas, for benefit of fellow members attending Boston Chapter's outing at Stowe Country Club. Right: Golfers gather and try their form. Swimming, softball, tennis, horseshoes and other sports were also enjoyed during the day, along with the "free lunch" and a bountiful dinner served at clubhouse in the evening to the hungry engineers

Coming Meetings

BALTIMORE—October 31, Hallowe'en Dance, Hotel Emerson.

BOSTON—October 30-31, November 1, ASTE Semi-Annual Meeting, Hotel Statler.

CLEVELAND—March 15-19, ASTE Exposition and 16th Annual Meeting, Cleveland Public Auditorium.

DENVER—November 5, Oxford Hotel. Speaker: S. A. Brandenburg, Sales Mgr., Monarch Machine Tool Co., Sidney, Ohio. Subject: National Machine Tool Show Review, illustrated with slides and films.

DETROIT—October 16, Engineering Society of Detroit. Speaker: O. W. Winter, Pres., Acme Pattern & Machine Co., Buffalo, N. Y. Subject: "What Is Tool Engineering?" October 23, same place. Speaker: Rudolph Esch, Sales Mgr., Machinery Equipment Div., Vickers, Inc., Detroit. Subject: "Hydraulics Applied to Machine Tools." October 30, same place. Cutting Tool Design Symposium. Speakers: C. J. Oxford, Chief Eng., National Twist Drill Co.; A. P. Smith, Chief Eng., Eclipse Counterbore Co.; H. H. Gotburg, Chief Eng., Colonial Broach Co.; and C. F. Weckesser, Chief Eng., Gorham Tool Co., all of Detroit. Business meetings second Thursday of each month.

ELMIRA—Annual Ladies Night, November 3, 7:00 P.M., Mark Twain Hotel. Speaker: Harry Coopland, lecturer. Subject: "So You Have Been Asked to Speak."

HOUSTON—October 14, Ben Milam Hotel. Speaker: S. A. Brandenburg, Sales Mgr., Monarch Machine Tool Co., Sidney, Ohio. Subject: "A Preview of New Turning Machines."

MILWAUKEE—November 13. Speaker, J. T. Welch, Sheffield Corp., Dayton, Ohio. Subject: "Crush Grinding" illustrated with slides.

PHILADELPHIA—October 16, "Prof. I.Q. and Information Please," conducted by T. J. Donovan, Jr. Quiz program on steel selection and heat treatment. Silver dollar prizes. Visiting members invited.

TOLEDO—November 12, 7:00 P.M., Toledo Yacht Club. Speaker: P. M. McKenna, Pres., Kennametal, Inc., Latrobe, Pa. Subject: "Carbide Tools and Appliances."

Shows Speed and Economy Of New Welding Techniques

Toronto, Ont.—"Save time, save money and prevent waste with a welding and cutting unit that's portable, profitable and prompt," said R. D. Margesson of the Dominion Oxygen Co., speaking September 3 before more than 100 Toronto Chapter members on "Developments in Welding and Cutting."

Illustrating his talk with slides and a motion picture, the speaker explained many processes developed during the war and now in general use.

Sequences showing the cutting of billets 66" thick with a gap 3/8" wide created great interest. Outstanding feature of these operations, the speaker stated, is the smooth, square, easily machined finish. With no hard spots, blisters or excessive scale, he added, to mar or dull cutting tools, cutting and machining operations prove fast and economical.

The motion picture also showed quick, effective welding of boiler tubes, with special machinery demonstrating butt-welding at its best.

At the close of the lecture, the speaker answered questions and displayed samples of clean, strong welds.

A. E. Rylander, Technical Editor of *The Tool Engineer*, stressed the potentialities of ASTE as a factor in peace as well as in war. The Society, he continued, knits together tool engineers throughout the world and sets an example of friendship and good-fellowship that nations might well emulate during these trying, unsettled days.

Mr. Rylander's visit afforded many members their first opportunity to meet the author of the popular *Andygrams*.

Chairman L. M. Jardine presided and First Vice-Chairman John Lengbridge spoke briefly on proposed educational activities for the coming year, thanking those who had volunteered to serve as class instructors.

Motion Picture Lecture Shows Grinding Methods

Denver, Col.—R. O. Anderson, District Manager, Norton Co., presented a film lecture on grinding wheels before 30 members and guests of Denver Chapter at a meeting September 3 in the Oxford Hotel.

The motion pictures included "Manufacture of Grinding Wheels," "General Uses of Grinding Wheels," "Grinding Carbide Cutting Tools," and "Maintaining Diamond Wheels."

The final film, "Grinding Wheel Markings," described the standard identifying marks now being used by all manufacturers of grinding wheels.

Between films, Mr. Anderson answered questions from the audience. During one of the discussion periods, the speaker revealed that the vaults in the Denver Mint had been used by the government for storing industrial diamonds during the war.

Plans were made during the meeting for the Chapter's first Christmas.





Left: Detroit Chapter golfers register admiration for the effortless 225-yard drive with which Lloyd Briggs, Chairman, Special Events Committee, opens the Annual Stag-Day Get-Together at Forest Lake Country Club. Right: C. S. Abbott (right) is congratulated by L. Barnes on score which made him winner of the Chapter's annual golf trophy

Columbusites in New Posts

Columbus, Ohio—W. R. Opp, formerly Superintendent of Tooling and Methods at Ranco, Inc., has been promoted to Factory Manager.

* * *

Rudolph C. Gordon has been appointed Master Mechanic of the Irving Auger Bit Co., Wilmington, Ohio. Mr. Gordon, who heads the Industrial Relations Committee of Columbus Chapter, was previously Superintendent at Yale Machine Products, Inc.

* * *

Fred W. Plapp is now Chief Design Engineer with the Universal Concrete Pipe and Equipment Co. He was recently associated with E. H. Munro & Associates and serves as Chairman of Columbus Chapter Public Relations Committee.

* * *

Lyle Bingaman has been transferred from Columbus to the Marshalltown, Iowa, plant of the Lennox Furnace Co.

Abbott Captures Golf Cup

Detroit, Mich.—At the Annual Stag-Day Get-Together, staged this summer at Forest Lake Country Club, more than 250 golfers, members and friends of Detroit Chapter, teed off with plenty of spirit and high hopes of winning one of the many prizes offered.

This year's trophy was won by C. S. Abbott, Chapter member, who shot a neat 76. Guest and one of the leading Michigan amateurs, "Chuck" Kocsis gave all present a lesson with a scintillating 4 under par 68.

Prizes awarded for golfing feats, and others for pure luck, included sport shirts, putters, bags, matched woods and irons.

After the tournament, those with appetites had dinner at the clubhouse.

Way Named Sales Manager

Cleveland, Ohio—William E. Way, former Chief Engineer of Manufacturers Machine Shop, Inc., has been appointed Sales Manager of Precise Metal Products, Inc.

Mr. Way will be responsible for coordinating sales of the company's tool and die, stamping and plating services. He is a member of Cleveland Chapter.

Picnickers Feast on Steer

St. Louis, Mo.—An attendance of 275, plus the careful preparations of the committee in charge and the weatherman's gay mood, combined to make St. Louis Chapter's annual stag picnic an outstanding success. The yearly outing took place this summer at Tammes' Grove in Fenton.

Featured entertainment included softball, horseshoes, swimming and other sports.

Piece de resistance of the picnic feast was a prime steer, contributed by Charles Emerling, Chairman of the Entertainment Committee and amateur farmer, and prepared by Eric Schafermeyer and his staff.

Prizes awarded to winners of the sports events included mechanical pencils, electric fans and clocks—and a billy goat. The Gate Committee welcomed each member and presented grab bags.

Joins *American Machinist*

New York City—H. E. Linsley, former Machine Tool Editor, *The Iron Age*, has joined the staff of *American Machinist* as an associate editor.

Prior to his connection with *Iron Age*, Mr. Linsley was associated with Wright Aeronautical Corp.

He is a Past Chairman of Northern New Jersey, ASTE, and a member of the National Program Committee.

Charles Emerling (center) and his sons, Roy (left) and Carl, arrive at St. Louis Chapter outing with gift steer (in truck) from their farm, for *piece de resistance* of feast which highlighted picnic in Tammes' Grove, Fenton





Louis Nanchy (beside operator), Tool Room Supt. of General Electric plant at Ontario, Calif., and son watch blanking of lamination rings in company of some of the other members who participated in Los Angeles Chapter tour of plant

De Vou Engineers Amateur Chefs' Initial Culinary Effort

Boston, Mass.—Invading a traditionally feminine field, a group of Boston business and professional men have demonstrated that half a dozen of the sterner sex can toss up as tasty a repast as the "little woman" does.

Responsibility for the first dinner prepared by the recently organized Boston Chapter of the Society of Amateur Chefs was shouldered by J. Laird de Vou, Jr., Treasurer of Johnson, de Vou, Inc., and Chairman of the Arrangements Committee, Boston Chapter, ASTE.

Mr. de Vou, who concocted all the main dishes for the feast enjoyed by the entire membership of the local culinary organization, was assisted by Donald Parsons, mortician; John C. Brink, advertising sign manufacturer; Harold W. Scholl, electrical appliance dealer; and J. Howard Bushway, ice cream manufacturer, who furnished other courses.

Edward Bryce Bell, President and General Manager of the Somerset Hotel, elected "Grand Chef" by the group, made part of his hotel kitchen available to the amateurs and directed the proceedings.

Objective of the national organization, of which the Boston group is the second Chapter, is "to advance and popularize good cooking among men in the United States who wish to cultivate the art as a hobby or avocation."

For their meetings, the members don white caps and aprons. A soup ladle serves as gavel. One of the qualifications for membership is the submission of an acceptable original recipe.

The non-professional chefs say that the increasing interest in cooking displayed by men is due partly to their gadget consciousness developed through the introduction of grills and other equipment for outdoor cooking, and partly as a result of the training in food preparation which so many received in the armed services.

Canadians Have Field Day

Toronto, Ont.—Three hundred and twenty members and friends of Toronto Chapter turned out to play golf, baseball and other sports at the annual summer Field Day.

This year's event, held at The Elms Golf Club in Weston, was favored as usual with fair weather.

During dinner at the clubhouse, group singing was enjoyed and Chairman L. M. Jardine rendered solos. Attractive prizes were awarded to winners of the day's contests.

Recently-organized Boston Chapter of Society of Amateur Chefs concocts first dinner under direction of J. L. de Vou, Jr., Boston Chapter, ASTE. Behind table, from left, are: Donald Parsons, mortician; J. C. Brink, sign manufacturer; Leland Waters, transportation official; Mr. deVou, B. R. Vaughan, banker; and H. W. Scholl, electrical appliance dealer. At left, E. B. Bell, head of Somerset Hotel in whose kitchen meal was prepared, serves as major-domo

Photo Courtesy Christian Science Monitor



Lamination Dies Eliminated In Electrical Motor Making

Los Angeles, Calif.—The many operations required to manufacture motors were studied by a large group of Los Angeles members who participated August 14 in a tour of U. S. Electrical Motors, Inc.

All castings at the U. S. plant are normalized before machining. They are bored and faced on special machines which perform various operations in automatic cycles. Drilling and tapping of the bases is done on drill presses with the aid of simple drill jigs.

A secret process of asbestos impregnation is used by the company to protect the motor windings. The coils are immersed in a bath and asbestos fibers are deposited electrostatically in the voids between the wires.

Almost all motor laminations are produced on simple, relatively inexpensive dies. First a number of concentric rings are blanked out in large compound dies. From there they go to very light punch presses, where one index notch or hole is pierced. The slots which later receive the windings are notched on automatic, indexing, Toledo notching presses. In this setup dies costing approximately $200 do the work of lamination dies running into thousands of dollars.

This method of manufacture, the visitors learned, is well justified in view of the many different types of motors produced and the resulting limited runs.

In the machine shop, the engineers saw "Magnamatic" automatic lathes, gear hobbing and shaving machines, and some fine gear testing equipment.

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TOOLS OF TODAY

Unusual Collet Head

A universal dividing **COLLET HEAD**, for both grinding and milling, by the *Matco Tool Company*, 2834 West Lake Street, Chicago 12, features a sturdy graduated base, Torrington precision needle bearings and hardened and ground index plate. Standing 5¾" high, this dividing head has felt seals for dust protection and takes up to 1" capacity in ground thread collets.

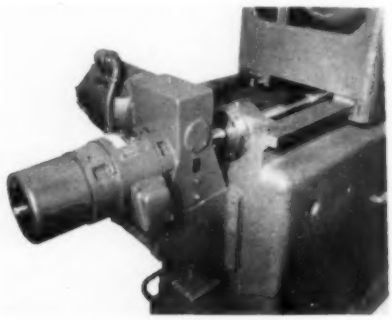


The many applications of this collet head include angle, flat and hexagon milling and grinding and, with attachments, the tool can perform collet grinding on external grinders, sharpen plain mills, side mills, and end teeth on end mills. Also, in the attachment category, the collet head can be used for diamond dressing radii and angles on grinding wheels. **T-10-1**

New Drive for Machine Tools

A new, **FEED-TRAVERSE DRIVE** for machine tools, composed of an a-c traverse motor and a d-c feed motor packaged into one unit, has been developed by engineers of *General Electric Company*, Schenectady, N. Y. Completely factory assembled, the new drive produces a wide range of stepless feed and traverse speeds with close speed control. Feed speed ranges of 20:1 or greater can easily be provided.

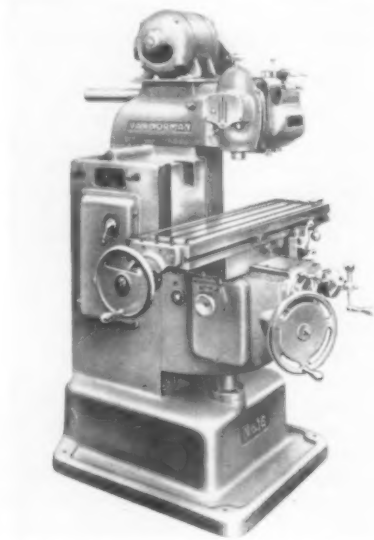
Both motors in the unit drive into a differential gear which has a single output shaft. The gear output shaft is so constructed that in many cases it can be coupled directly to the lead screw of the machine. By installing wide-speed-range control for the feed motor, all the feed speeds required can be obtained without the need for additional gear changes.



Individual mounting of the parts is not necessary, since the component parts are all assembled as a unit at the factory. To install, the gear end of the unit is simply mounted on the machine to be driven. The unit can be easily inspected and oiled without removing it from the driven machine. **T-10-2**

New Ram Type Miller

A new Ram Type **MILLING MACHINE**, by the *Van Norman Company*, Springfield, Mass., is especially applicable for tool room, pattern shop, die and mold shop, experimental laboratory, repair shop, and general purpose milling.



Embodying the usual versatility of Van Norman ram type millers, the new machine features an adjustable cutter head and movable ram which permits horizontal and vertical as well as angular milling with standard milling cutters and conventional milling practise. Thus, work can be carried through to completion, without change of setup, with a marked saving of time on simple as well as difficult milling operations. Built to Van Norman standards, it is a quality tool throughout. **T-10-3**

Use This Coupon for Complete Information:

For your convenience, a key number follows the announcement of each product reviewed in the *Tools of Today* section of THE TOOL ENGINEER. To obtain complete information on any of these products which may prove useful to you, it is necessary only to circle the corresponding key numbers on this coupon, then mailing the coupon to THE TOOL ENGINEER.

Tools of Today Department, THE TOOL ENGINEER
550 West Lafayette Blvd., Detroit 26, Michigan

Gentlemen:

Please send me further information on the following *Tools of Today* items which I have checked:

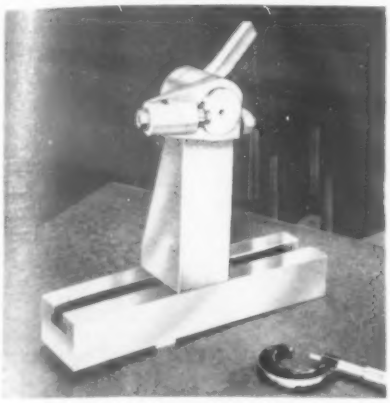
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Name .....

Firm .....

Street ..... City, State.....

Tru-Matic Wheel Dresser



A precision **WHEEL DRESSER**—the Tru-Matic—by *Erickson Tool Division*, 2309 Hamilton Ave., Cleveland 14, Ohio, has been especially developed for dressing wheels for internal grinders. Designed for repetitive grinding, the dresser need not be removed to use the machine. An Erickson diamond holder, incorporating a precision collet, permits the diamond to be turned in any direction; also, an easy movement of the locking lever permits the diamond to be turned away from the wheel. Fully described in a circular, available on request. **T-10-4**

Bench Oven Furnace

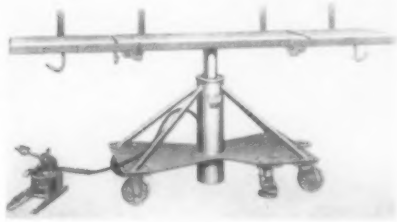
Eclipse Fuel Engineering Co., 759 So. Main St., Rockford, Ill., has completely redesigned its Model 1-B Eclipse **BENCH-TYPE OVEN FURNACE**, for use particularly in small tool shops and other shops not requiring elaborate or expensive heat treating equipment. This furnace is especially suitable for intermitttent use in hardening punches, dies, and small tool or brazing applications in shops where space is limited.



Combustion equipment includes burner and McKee Proportional Mixer, providing nozzle valve temperature control. Low pressure air suply (10 to 16 oz.) is required. Temperature range is 1400 to 16° F. Bulletin D-1 gives complete information on this and other shop furnaces. **T-10-5**

Press Feeding Tables

By *Lyon-Raymond Corporation*, 3454 Madison St., Greene, N. Y., a hydraulically operated **STRIP AND SHEET FEEDING TABLE** designed to accommodate bundles of stock loaded by means of overhead hoists or fork trucks. Bcause of its hydraulic elevating table, a press operator can keep stock at the desired height for feeding into dies or shears, thus eliminating awkward manual handling and bending of stock.



Also by Lyon-Raymond, a **TIL-TABLE**, for strip and sheet stock, for use with inclined presses as well as horizontal bed types. With this table, which has a range from horizontal to 30°, it is possible to feed strip or sheet stock at the correct angle, with full support and proper levelling. Both of these tables, which are provided with extensions, offer marked economies in press rooms, not only in increased production but in reducing damage to sheets and strips. Both machines are portable. **T-10-6**

New Squaring Shears

New **SQUARING SHEARS**, by *Columbia Machinery and Engineering Corporation*, Hamilton, Ohio, incorporate longer shear blades than are normally required for cutting full width material. An opening at one end equal to the maximum material thickness, eliminates tearing or nicking when trimming or notching sheets longer than the blades.

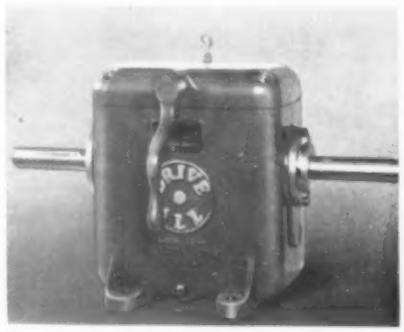


An easily read stainless steel scale is mounted in the shear table, and the machine is further equipped with a mechanically operated automatic hold-down, with individual high-compression spring compensating fingers and a dependable finger guard located in front of the shear blade. Standard throat depth is 18", and the shears are made in three sizes—6 ft., to shear ¼" mild steel at 60 strokes per minute, and 10 and 12 ft., for 3/16" stock at the same speed. **T-10-7**

Industrial Transmissions



Two new developments have been announced by the *Drive-All Manufacturing Company*, Detroit builders of industrial transmission equipment. The **DRIVE-ALL MODEL 1000 TRANSMISSION** has a capacity for loads ranging from 10 to 30 H.P. at a low R.P.M. output. This transmission can be furnished with or without mounting brackets for supporting the heaviest motors.



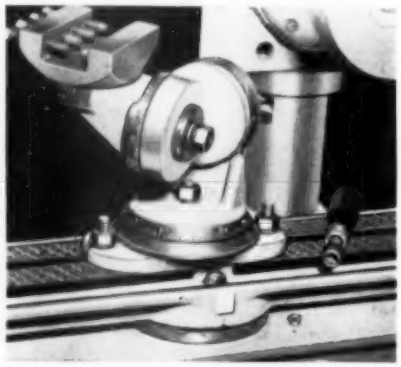
Another new development is the **DRIVE-ALL CLUTCH AND BRAKE UNIT**, for use with the lighter capacity Drive-All transmissions. Application of the "clutch and brake" action makes instantaneous stopping possible which is extremely important in the operation of sensitive machinery requiring this feature. **T-10-8**

New Liquid Concentrate

Tested over a period of several years, and introduced at the recent Machine Tool Show in Chicago, a new **COOLANT** by the *Anderson Oil Company*, 505 Brownstone Ave., Portland, Ct., is said to meet the severe requirements of modern, high speed production on tough alloys. A liquid concentrate (named Lusol) is used with 10 to 75 parts of water. Providing a true solution—not an emulsion—Lusol is said to have low interfacial tension and, because of this, gets between the tool and the chip with unusual rapidity and thereby prevents the formation of heat. It is further claimed that it does not evaporate or become rancid. **T-10-9**

Universal Grinding Fixture

A new Universal **WORK HOLDING FIXTURE**, recently introduced by the *K. O. Lee Company*, Aberdeen, So. Dakota, manufacturers of "Knock-Out" cutter grinders, has four graduated quandrants that permit fast, accurate setting of any simple or compound angle.



While designed primarily for carbide and hi-speed tool grinding, the fixture —which is equipped with a 1½″ vise, with 2″ available—can be widely applied to may other small grinding operations requiring simple and compound angles. It can be furnished to fit practically any make of cutter or surface grinder. **T-10-10**

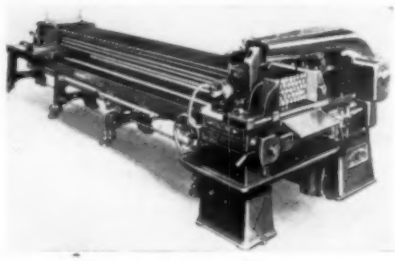
Radius and Angle Wheel Dresser

A Radius and Angle **WHEEL DRESSER**, by *Matco Tool Company*, 2834 West Lake Street, Chicago 12, forms concave or convex radii, with any two angles tangent, in one continuous motion without stopping. With the new Micro diamond adjuster, the diamond can be set to "tenths" for accuracy.



The dresser, which features micrometer feed to the wheel for precision dressing, has a special tip-back column which eliminates necessity of removal of dresser from table. Completely dust proof, and with all wearing parts hardened and ground, the dresser also can be had with a sub-base for "T" slot machines. **T-10-11**

Metal Cutting Machine



A full line of single purpose and production type **METAL CUTTING MACHINES** by *Racine Tool & Machine Company*, Racine, Wis., includes a new 10″ x 10″ capacity general purpose Utility Type Machine, incorporating new and interesting feeding and cutting principles. This machine, which was among the many interesting exhibits at the recent Machine Tool Show, is described—along with other Racine tools—in literature available from the company. **T-10-12**

New Versatile Grinder

A new offhand or freehand **GRINDER** —C-T Model 63—featuring individual arbor mounted wheels and a triple-speed selection, by the *Corlett-Turner Company*, 1001 So. Kostner Ave., Chicago 24, has been especially designed for a wide variety of small tool grinding jobs. Every consideration has been given to making possible increased grinding efficiency.



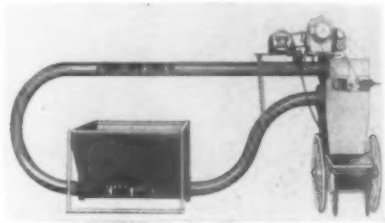
Each grinding wheel, which can be changed in a matter of seconds, is mounted on a ground tapered arbor which fits into a hardened and ground socket in the spindle. A slight wrist motion, on the end bells of the grinder head, releases the wheel arbor and the reverse motion instantly locks it. Thus, there is more assurance that the right wheel will be used. Wheel dressing is also reduced to an absolute minimum since, regardless of the frequency of changing, the mounted wheel will run as true as when previously used.

The new grinder incorporates a 3-speed pulley arrangement which permits the selection of the right spindle speed for any vitrified wheel from 1″ to 4″ in diameter.

Apart from its primary use as a grinder, the tool is adaptable for deburring operations, polishing, buffing and many other applications. In addition, a collet type arbor permits use of all types of mounted wheels and tools such as rotary files, drills and countersinks. **T-10-13**

New Sediment Remover

A new mechanism, known as the **"HOUDAILLE CONVEYOR,"** is being marketed by *Honan-Crane Corporation*, manufacturers of oil purification and clarification equipment, 676 Wabash Ave., Lebanon, Indiana. It is designed for completely automatic removal and transfer of sediment from settling tanks without removal of fluid.



Basically an endless link-chain, motor-driven, on which 4-inch neoprene rubber flights are mounted at 6-inch intervals, the conveyor operates through the V-bottom of the settling tank, trapping the sediment between the flights and conveying it through a 4-inch pipeline to a collection and disposal point. The conveyor turns sharply upward upon leaving the tank, thus allowing fluid to drain back. **T-10-14**

Packless Valve



The *Henry Valve Company*, 3260 W. Grand Avenue, Chicago 51, has introduced a new type of Push-Button **PACKLESS VALVE**. Suitable for pressures up to 100 pounds, the valve has a forged brass body and will handle oil, air, water, or any substance not corrosive to brass. Normally open, it is designed for operations where either manual or automatic instantaneous valve operation is desired, and where leakage around conventional packing would be objectionable. **T-10-15**

Variable Stroke Cylinder

Baker-Holth Manufacturing Company, Port Huron, Michigan, has developed an adjustable stroke **AIR CYLINDER** which offers distinct advantages when it is necessary to lengthen or shorten the stroke of the piston for different applications. This type of cylinder might often be used in place of several cylinders of set stroke construction.



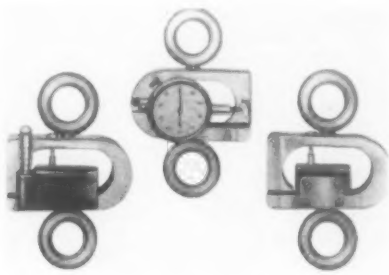
In addition to the regular double acting piston for operating the piston rod, this cylinder is provided with a stop piston for setting of the required stroke by turning the hand wheel shown at right hand end of cylinder. The hand wheel acts as a nut over a threaded hollow center shaft which is grooved and keyed to the cylinder end cover and fastened to the stop piston.

Various bores and strokes can be made with the adjustable stroke control feature to suit individual requirements, on either air or hydraulic cylinders.

T-10-16

"Monitor" Switch

The Dyna-Switch, by *W. C. Dillon & Co. Inc.*, 5410 W. Harrison St., Chicago 44, is a versatile **"MONITOR"** which weighs loads up to 10,900 pounds, flashes caution signal, rings bell, and cuts out the hoist motor on chain or cable hoist overhead cranes. Made of special alloy tool steel, and weighing only 3¼ lbs. it can be attached between overhead rail and hoist, or between hoist chain and hook. On cranes it is placed directly on hook.



Said to always return to true zero regardless of repeated stresses, it withstands accidental overloads far in excess of the limit called for by hoist or crane without affecting calibration.

The "monitor", which incorporates the Burgess Micro-Switch, is made in the Basic model, with motor cutoff; Visual model, with red caution lamp; and Weight model, in seven types—from 0-100 lbs., to 0-10,000 lbs.—with indicators showing 1 to 100-lb. divisions.

T-10-18

New Horizontal Band Saw

A new, Wet Model **HORIZONTAL BAND SAW** by the *Johnson Manufacturing Corporation*, 624 Chrysler Building, New York 17, permits the handling of certain types of production work, with higher speed cutting than is practical on the Dry Model Johnson Band Saw.



Of 10" x 18" capacity and designed for production cutting, the Wet Model gives maximum cutting efficiency without impairing the simplicity of operation. It is claimed that production can be increased, on certain jobs, by as much as 200% and this, together with longer blade life, allows the machine to do cutting jobs ordinarily performed on more expensive tools. Fully described in a catalog, available on request. **T-10-20**

Fluid Power Transmission

Applicable to a wide variety of industrial uses, a new **FLUID POWER TRANSMISSION** by *The Oilgear Company*, 1301 W. Spruce St., Milwaukee 4, Wis., consists of a volumetric, variable delivery, radial rolling piston pump driving or constant displacement radial rolling piston motor. A compact case encloses the operating mechanism while integral relief valves guard against overload.



Providing accurately controlled rotary motion with smooth, stepless, and uniform acceleration from zero to maximum, the transmissions have variable output speed, at normal torque, up to 1600 RPM. Starting torque is 125 inch-pounds, normal continuous torque 90 inch-pounds, with peak (10% of time) 135 inch-pounds. **T-10-17**

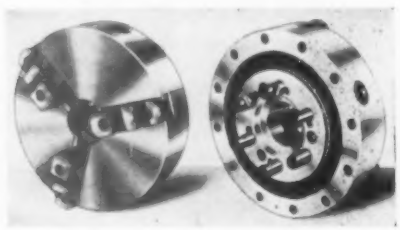
Ex-Cell-O Power Units



Style 20, smallest of the **HYDRAULIC POWER UNITS** by *Ex-Cell-O Corporation*, Detroit 6, is designed for operating small diameter tools at high spindle speeds and at fast, continuous operating cycles. The automatic cycle includes rapid approach, two infinitely variable dial adjustable feed rates, and rapid return and stop. The unit is arranged for electric start and emergency return control. Fully described in a booklet, available on request. **T-10-19**

New Aluminum Body Chuck

The *Whiton Machine Company*, 504 Howard St., New London, Conn., has developed and put into production a new **ALUMINUM BODY CHUCK**, made from special analysis aluminum known as "WHIT-ALLOY", that is claimed to have the strength of steel and the wearing qualities of cast iron but with the lightness of aluminum.



Because of its lack of excessive weight, the new chuck starts and stops quickly, eliminates drag, is easily handled in the tool room, and enables machine operators to change chucks rapidly. Furthermore, holding capacity of small precision lathes may be substantially increased due to lighter spindle loads.

Present models are made for direct mounting on American standard spindle nose, type D-1; however, additional chucks will be made for all mountings as the demand arises. Literature available on request. **T-10-21**

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This customer is honing cold drawn steel tubing on a Barnesdrill vertical No. 307 honing machine with a micromatic head. A 120-M Bay State stone removes 30 to 35 thousandths on the I. D. With Stuart's SUPERKOOL* Base mixed 4 to 1 kerosene no tool marks are in evidence, stone life is increased considerably, the finish is excellent and the customer praises SUPERKOOL No. 41* highly.

Douglas A. Deacon

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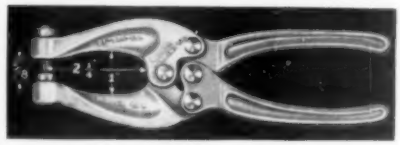
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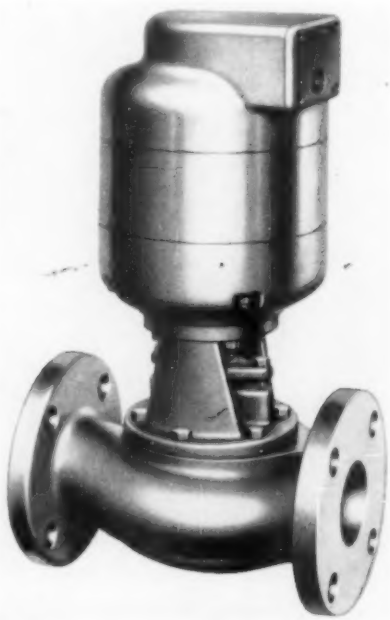
New De-Sta-Co Toggle Clamp



Designed for sheet metal work, plastic sheet cementing or laminating, and other operations requiring quick, positive pressure, a new portable **TOGGLE CLAMP**, by *Detroit Stamping Company*, 328 Midland Ave., Detroit 3, is applicable to a variety of processes and may be revamped for special applications. Toggle action of the tool, which is forged, is said to be especially suitable for template locating. Provided with replaceable hardened steel bushings, to minimize wear, the clamp is adjustable for efficient pressure on various thicknesses and provides a firm hand grip for opening and closing. **T-10-22**

New "Rumaco" Pump

A new "Rumaco" **CIRCULATING PUMP**—Model "1-B"—by the *Ruthman Machinery Company*, Cincinnati 2, Ohio, is constructed on centrifugal principles and provided with opposing inlet and outlet for standard (125 lb.) 2" pipe flanges. The unit can be easily installed in a pipe line of various sizes by use of pipe reducers, and may be operated in any intermediate angle from vertical to horizontal.



The driving motor, direct connected to the Pump, is a totally enclosed type and equipped with grease packed, sealed, precision ball bearings. As no added lubrication is necessary, all oilers and grease fittings have been eliminated. The motor stator is dynamically balanced by dynetric process to extremely close limits, insuring vibrationless and quiet operation. **T-10-23**

New Locating Microscope

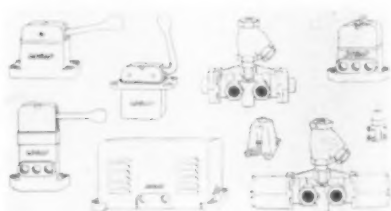
A new **LOCATING MICROSCOPE**, which reverts the image to upright and easily picks up edges, contours, irregular shapes, and holes too small for an edge finder or indicator, is a recent development by the *Moore Special Tool Co., Inc.*, of Bridgeport, Conn. An optically engineered precise roof prism, in the instrument, enables the operator to see the work in the same position as without it. Thus, table settings can be made, instinctively, without the confusion of transposing reversed or inverted table movements as in conventional compound microscopes.



In addition to a double pair of cross lines, spaced .001" apart, the Moore reticle contains conveniently spaced concentric circles with broken lines to facilitate locating small holes, or large radii, otherwise covered by the line. Magnification of 40x—enough to see a "tenth"—is achieved without unduly reducing the field of vision or making adjustments too critical.

Designed for use in the Moore Jig Borer or Moore Jig Grinder, the instrument extends the usefulness of either machine by converting them into inspection machines for hole location, contour shapes, finish or surface conditions. Locational accuracy is quickly determined by substituting the microscope for the cutting tools or grinding heads, and work may be checked without disturbing the set-up in the machine. **T-10-24**

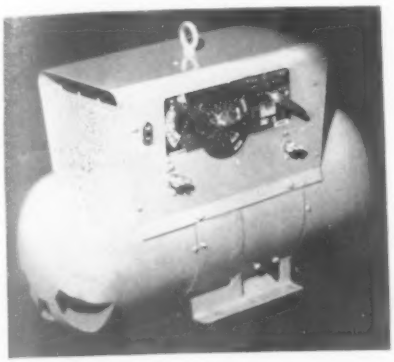
Logan Line Redesigned



Completely redesigned, the new Logan line of **AIR CONTROL VALVES**, by *Logansport Machine Company, Inc.*, 905 Center Ave., Logansport, Ind., includes 79 standard models all of which are now available. The line is fully described in a 48 page catalog which may be had by writing on company letterhead, with business stated. **T-10-25**

New G-E Electric Arc Welder

A new line of General Electric single-operator high speed d-c **ARC WELDING MACHINES**, Type WD-40, are designed for 50% savings in size and weight and improved welding characteristics. Operating at 3500 rpm, the new welders are available in 200, 300, and 400-ampere models. Compact, weight-saving design makes them easily portable, saves floor space, and permits full utilization of underbench and balcony space.



The arc is easily established and maintained with the new welders because full arc voltage is generated instantly after short circuit, thereby avoiding unexpected pop-out of the arc. Excessive weld spatter is reduced because current peaks are adjusted for best performance on any setting.

The standard assembly includes a stationary welding generator, driving motor, control cabinet and panel, and a motor starter assembled into a single, compact unit. A two-wheeled, balanced running gear is available as an optional feature. **T-10-26**

Differential Air Engines

A new line of **DIFFERENTIAL AIR ENGINES**, by the *National Pneumatic Company*, Rahway, N. J., incorporates a piston assembly presenting two different diameters. Constant air pressure, from line or reservoir, is introduced between these diameters and, as the pressure acts on the large and small ends, the result is a force equal to the difference between the two areas.



The differential principle permits operation with only one controlled air line, with a consequent simplicity in piping and controls that makes these engines particularly desirable for use in multiple hook-ups or where controls are remotely located. Moreover, positive air power is obtained in both directions so that, at 100 lbs. air pressure, standard engines are available in sizes to deliver "in stroke" power ranging from 100 to 1335 lbs., and "outstroke" power from 105 to 1070 pounds **T-10-27**

Poppet Type Valve

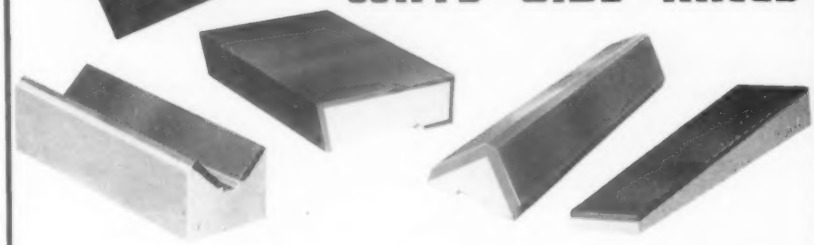
A new, small, low cost **POPPET TYPE VALVE**, by *Ross Operating Valve Company*, 6494 Epworth Blvd., Detroit 10, is designed expressly for operation of light machine tools, vises, fixtures, presses, and other machinery adaptable to air control. High quality of materials and workmanship is emphasized, construction being of brass and stainless steel, with a hi-carb neoprene valve seat.

Interesting feature which contributes to its versatility is the optional hand lever or foot treadle at the same cost, the vertical lever action being particularly suitable for small machine tool



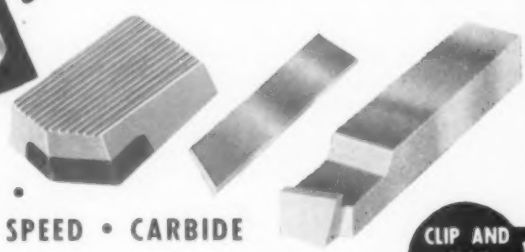
installations. In the foot treadle style, No. 600 is 3-way, No. 601 4-way. The hand lever type No. 602 is 3-way, No. 603 4-way. All are available in locking, non-locking or neutral-position types. **T-10-28**

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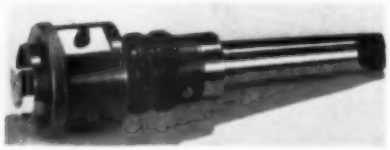
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Ratio Recessing Tool



The standard line of recessing tools, by the *Maxwell Company*, 386 Broadway, Bedford, Ohio, has been expanded to include a new **RATIO RECESSING TOOL**, designed for operation on high speed automatic machines to accomplish grooving, backfacing, and recessing with extreme accuracy. Cutter of tools moves in a radial direction in a predetermined ratio ranging from three to eight times more slowly than the forward movement of the spindle so as to maintain the proper cutting feed. This feature adapts tool to high speed production on machines where operations other than recessing can be performed rapidly.

The new ratio tools are available in four standard sizes for grooving, backfacing, and recessing holes ranging from ⅜ to 4″ in diameter. All tools utilize standard size straight shanks of 1, 1½ and 2″ and all shanks are interchangeable to permit tools to be used on any available machine in production.

T-10-29

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New Projectoform Grinder

The new **PROJECTOFORM GRINDER**, by the *Sheffield Corporation*, Dayton, Ohio, incorporates among other interesting and unusual features an optical system that uses either contour or opaque projection with surface illumination and 25:1 or 50:1 optical magnification. A prism, incorporated in the optical system, places the image in a natural position with the work in such a manner that confusing opposites in movement and projection are avoided.



To insure long life, and firmness and essential rigidity along with ease of movement, all moving ways of the machine are provided with anti-friction bearings completely sealed in. Remote control of wheel movement is accomplished hydraulically, permitting the operator to sit comfortably before the projection screen, while manipulating conveniently placed micrometer wheels. The operator can see the work and wheel in natural colors highly amplified on the screen, a marked advantage when grinding intricate work to close limits of tolerance. **T-10-30**

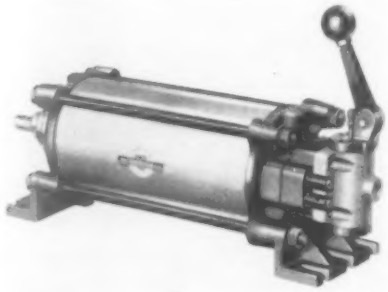
Electrodes for Alloy Steels

ELECTRODES 67 AC and **670 DC** for welding alloy steels have been added to the line of "Low Temperature EutecTrodes" by *Eutectic Welding Alloys Corporation*, 40 Worth Street, New York 13. The new electrodes for arc welding have a high alloy content for joining, filling, filleting, and overlaying all types of steel where high tensile and impact strength; good heat, corrosion, and wear resistance; and high hardness values are required. They can also be used for overlay material on cast iron.

The flux-coated EutecTrode 67 is fast flowing, free from spatter and from undercutting. Weld metal can be deposited at the highest possible speed at low-base metal heat, resulting in minimized distortion and scaling. Available sizes are 3/16″, 5/32″, ⅛″, and 3/32″ diameter. **T-10-31**

New Bellows Air Motor

A new, heavier and more powerful AIR **MOTOR**, known as the BM15 ("B" model, "M" motor), embodying the Bellows integral value design, has been added to the line of air motors made by the *Bellows Company*, Akron, Ohio, manufacturers of "Controlled-Air" Powered Devices.



Like the entire Bellows line of air motors, the BM15 differs from conventional air cylinder construction in that the valve and all operating controls are integral with the unit, with valve-operating lever adjustable to work from "any angle in any plane." Easily adjustable controls to regulate the speed of the piston in either or both directions are integral with the motor itself, eliminating the necessity of adding special speed control valves to the air line. Only one air connection is required and that may be a flexible hose. The unique design permits full and positive control, at all times, over every phase of air motor operation.

Model BM15, with its 4½" bore, develops a piston thrust of 15 times air line pressure, from any given line pressure up to 175 psi, and is available for immediate delivery, from stock, in many different styles and in stroke lengths of 1½, 3", 6" and 9" also, in virtually any stroke length on special order. **T-10-32**

New Low Cost Bench Plate

A solid, all granite **BENCH PLATE**, 12" x 18", announced by the *Herman Stone Co.*, 324 Harries Building, Dayton, Ohio, is available for quick delivery at a new low price.



Straight sided and easy to handle, and made of the same material as the standard line of Herman Stone plates, it is said to be accurate up to .00005" and to be long-lasting, non-abrasive, non-magnetic, temperature-resistant, rust-proof, and corrosion-proof. **T-10-33**

Lusol

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FOR COOLER HIGHER SPEED PRODUCTION WITH MODERN MACHINE TOOLS

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CLOSER TOLERANCES

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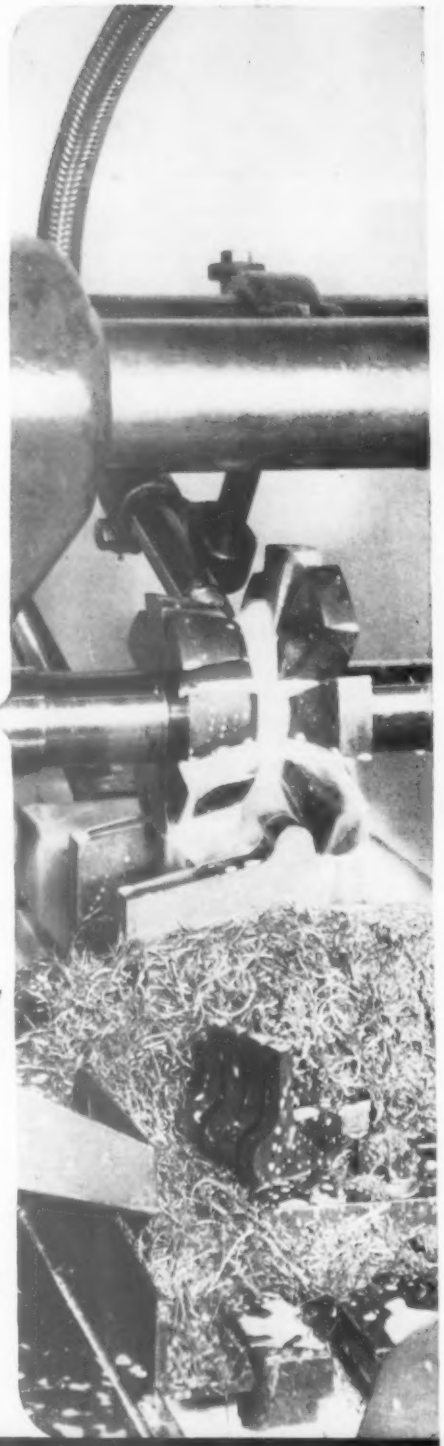
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North East West South in Industry

RICHARD Y. MOSS, who recently directed preliminary work in developing a new Sheffield subsidiary in Australia, has been named Sales Manager of the **Sheffield Corp'n** machine tool division and for the Measuray, X-ray gauge for non-contact measurement of continuous production.

The **DAVIS WELDING LIBRARY** at Ohio State University has on file more than 11,000 welding patents for which a new modern classification system was established this summer by **Dr. W. H. Simon** of University of Toronto. The Library Fund was set up some years ago by **A. F. Davis,** Vice-President of the Lincoln Electric Co.

PROGRESSIVE WELDER CO., Detroit, has acquired the **Warren Alloy and Machine Company,** which operated a non-ferrous foundry in Warren and a jig, fixture, die, gage, and punching unit plant in Detroit. Both plants will operate as a separate division of the parent company, under the name of **Warren Alloy and Machine Division.**

PHILIP C. SATTERTHWAITE has been elevated to the office of Vice-President in charge of manufacturing at **Cogsdill Twist Drill Co.,** Detroit 21. Before the war, he served the campany in various executive capacities. After his release, with the rank of Colonel, Corps of Engineers, he returned to Cogsdill where he was engaged in experimental development work.

Burdett Manufacturing Co., Chicago, builders of "Infra-Red" Gas Burners, has promoted **DONALD C. SCHEELE** to Gen'l and Sales Mfr. and **ROBERT B. McCORMICK** to Treasurer.

OWEN G. WATTERMAN has been promoted to Sales Manager at **Zagar Tool, Inc.,** Cleveland, Ohio.

EUGENE McLEES recently became associated as Sales Engineer with the Boston Branch of **Johnson-de Vou, Inc.** Mr. McLees was formerly with Fuller Merriam New England and with Norton Company.

JAMES W. KINNEAR, Jr., formerly with the Carnegie Illinois Steel Corp'n, is Executive Vice-President of **Firth Sterling Steel and Carbide Corp'n,** McKeesport, Pa. Mr. Kinnear has been associated with the Firth organization as a director since 1932.

Added to the directors of **The Monarch Machine Tool Co.,** Sidney, Ohio, are **L. L. WARRINER,** President of The Master Electric Co., Dayton, and **F. EBERSTADT** of F. Eberstadt & Co., New York, investment brokers.

Peninsular Grinding Wheel Co., Detroit, announces the election, as Comptroller, of **WILLIAM SCHENCK,** formerly of Ernst & Ernst, public accountants.

GURDON M. BUTLER, JR., is now Senior Engineer of **The Carborundum Co.** Research Div'n. Dr. Butler was formerly ch'f metallurgist at the Dunkirk, N. Y., plant of the Allegheny Ludlum Steel Corp'n.

To fill the new position of Executive Sec'y, **American Welding Society** directors have named **JOSEPH G. MAGRATH,** formerly sales mgr. of the McAlear Mfg. Div'n of Climax Industries, Inc.

Recently elected Vice-Presidents of the **Morse Twist Drill & Machine Co.,** New Bedford, Mass., are **MORTON W. RAINEY,** gen'l sales mgr., and **ANTHONY J. SNYDER,** works mgr.

OREST A. MEYKAR, ASTE member, is Managing Engineer of the **American Machinery and Materials Co.,** New York, having resigned his position with the U. S. Rubber Co.

Recent promotions at **Bullard Company,** Bridgeport, Conn., include **FRANK U. HAYES,** ass't sales mgr. to Sales Manager, and **E. PAYSON BLANCHARD,** sales mgr. to Director of Sales.

The appointment of **CHARLES G. HERBRUCK** to the Assistant Secretaryship of **The James F. Lincoln Arc Welding Foundation** is announced by Dr. E. E. Driese, Chairman of the Board of Trustees.

THE MICHIGAN TOOL CO., 7171 E. McNichols Rd., Detroit 12, has been awarded national and foreign sales right for the Orlandi Gear Checker, which performs production gear checking with pins and balls. The announcement was made by **A. S. Orlandi,** Pres. of **Orlandi Gear and Machine Co.,** Detroit.

The **BINGHAM-HERBRAND CORP'N** has been formed by the merger of **The Bingham Stamping Co.,** Toledo, O., manufacturers of emergency brake lever assemblies, and the **Herbrand Corp'n,** Fremont, O., for many years a leader in the commercial drop forging and the mechanics' hand tools fields.

H. BARDEN ALLISON is the new Sales Manager of the **Gilmer Div'n, United States Rubber Co.,** V-belt manufacturing and distributing unit in Philadelphia.

Added to the staff of **Bjorksten Research Laboratories,** Chicago, are **MISS MARIAN C. STOFFEL,** Technical Secretary, and **HARRY DeWALT, Jr.,** Research Chemist.

Allen-Bradley Co., Milwaukee, Wisc., manufacturers of electric controlling apparatus, announces the election of **FRED F. LOOCK,** formerly vice-pres. and gen'l mgr. to the position of President, and **HARRY L. BRADLEY,** to the office of Chairman of the Board.

The appointment of **H. L. BOETSCH** as Vice-President in Charge of Sales is announced by **Pennsylvania Flexible Metallic Tubing Company.**

In order to gain additional space required by greatly increased sales, the **U. S. DRILL HEAD CO.,** Cincinnati, Ohio, has sold its associate company, The U. S. Machine Tool Co., with entire inventory and fixtures, to N. Ransohoff Co., of that city.

All physical assets of the **Detroit Star Grinding Wheel Co.,** have been purchased by **PENINSULAR GRINDING WHEEL CO.,** Detroit, and will be completely modernized. This acquisition marks Peninsular's entry in the vitrified grinding wheel field. Previously, Peninsular specialized in resinoid bonded wheels.

E. B. CLEBORNE, Vice-President and Director since 1938, has been elected Executive Vice-President of **Allegheny Ludlum Steel Corp'n.**

Recent appointments at **General Electric,** Schenectady, N. Y., include **W. V. MERRIHUE,** Manager of Community and Employe Relations, and **J. S. SMITH,** Manager of Advertising and Sales Promotion, both of the GE Apparatus Dept., and **W. S. GINN,** Asst. Sales Manager, of GE Power Transformer Section.

The **29th ANNUAL NAT'L METAL CONGRESS AND EXPOSITION,** sponsored by **American Society for Metals,** will attract thousands of engineers to Chicago, October 18-24. All available floor space of the International Amphitheatre will be occupied by about 375 exhibitors. Show attendance during the two opening days will be by invitation only. During the week technical sessions of the participating societies will be combined—**American Welding Society, American Industrial Radium and X-Ray Society,** the **Iron and Steel Div'n,** the **Institute of Metals Div'n** of the **American Institute of Mining and Metallurgy,** and **American Society for Metals.** Each society has arranged an interesting schedule of technical sessions in addition to their annual business meetings.

PRODUCTION NEWS!!!

a new era in shaft-turning

The new BULLARD MAN-AU-TROL HORIZONTAL LATHE Model 30H produces three identical parts at once . . . with interchangeable manual or automatic control!

The new BULLARD Man-Au-Trol 3-Spindle Horizontal Lathe will enable you to *multiply* production on shaft-turning, grooving, facing, angle-turning or between-center chucking jobs — and to reduce costs proportionately. In addition, this latest BULLARD machine has many other improvements contributing to better workmanship and big savings in time and money.

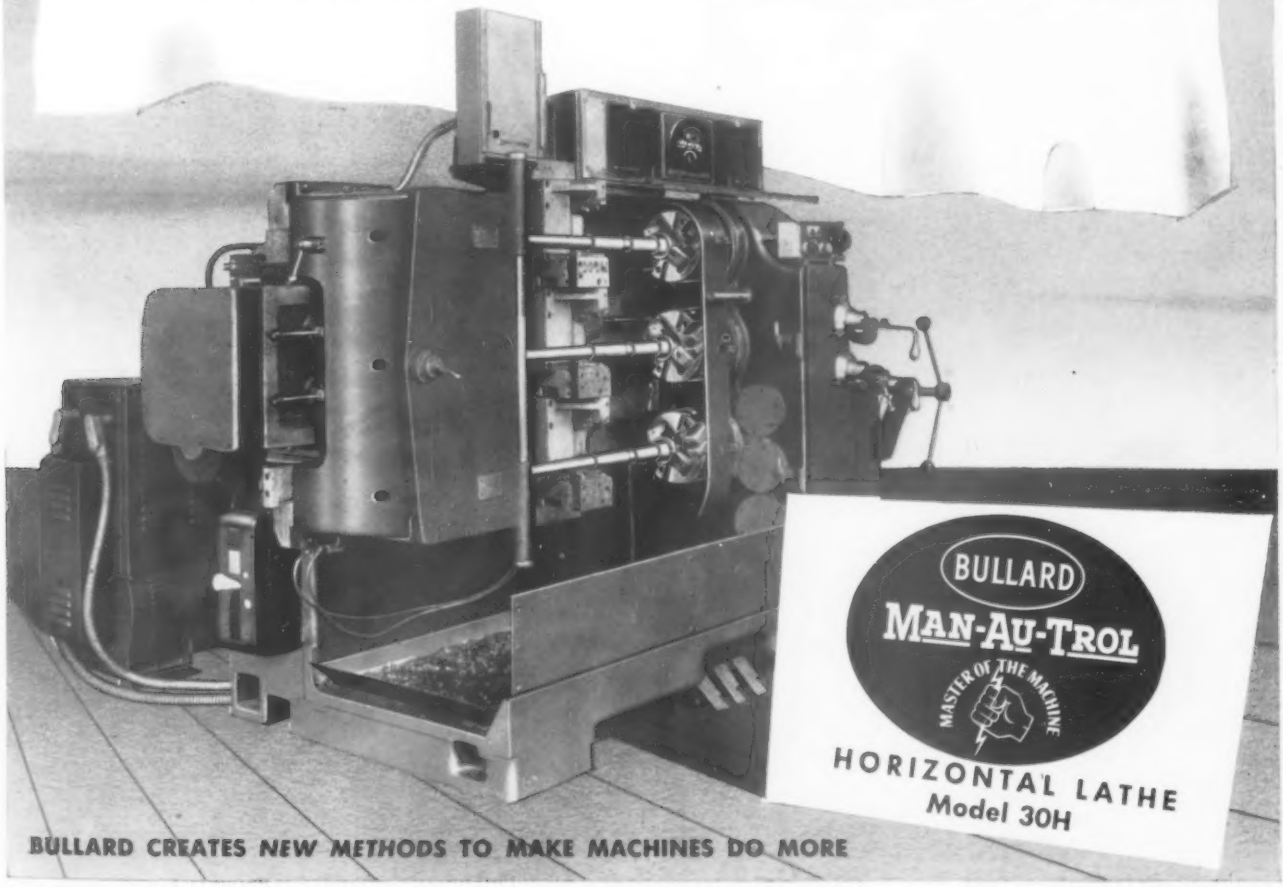
NO OTHER SHAFT-TURNING LATHE OFFERS ALL THESE ADVANTAGES

Hydraulic, centering-type chucks on all 3 spindles . . . each chuck operated by individual foot-treadle, freeing operator's hands . . . saddle and tool slide travel on vertical ways, free of chip area . . . full chip control, including automatic breakage for disposal, and prevention of accumulations around operating parts . . . complete visibility and accessibility of work and tools . . . massive weight and over-all rigidity assure minimum vibration for maintained accuracy . . . Man-Au-Trol control, head stock and all other machine-operating controls are at operator's right.

PLUS THE ADVANTAGES OF BULLARD MAN-AU-TROL

Providing manual operation on short runs, Man-Au-Trol enables quick conversion to 100% automaticity on longer runs. Controlling the head through *39 separate functions in any sequence*, it allows the machine to cut practically continuously, without stops for customary manual operations or loss of time due to the human element. While retaining the versatility of manual control for short runs, this new BULLARD machine can be quickly changed to fully automatic operation on production of 3 identical parts at once — substantially lowering manufacturing costs.

Why not find out how this cost-saving combination can benefit your own production? Engineering data and other facts on the new BULLARD Man-Au-Trol 3-Spindle Horizontal Lathe gladly sent on request. THE BULLARD COMPANY, Bridgeport 2, Conn.



BULLARD CREATES *NEW METHODS* TO MAKE MACHINES DO MORE



Statement of Ownership

STATEMENT of the Ownership, Management, Circulation, etc., required by the Acts of Congress of August 24, 1912, and March 3, 1933, of The Tool Engineer, published monthly at Detroit, Michigan, for October 1, 1947. State of Michigan, County of Wayne—ss.

Before me, a notory in and for the State and County aforesaid, personally appeared Robert B. Powers, who, having been duly sworn according to law, deposes and says that he is the Executive Editor of The Tool Engineer and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, executive editor, technical editor, and business manager are: Publisher, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich. Executive Editor, Robert B. Powers, 550 W. Lafayette Blvd., Detroit 26, Mich. Technical Editor, A. E. Rylander, 550 W. Lafayette Blvd., Detroit 26, Mich., Production Manager, James Curran, Jr., 550 W. Lafayette Blvd., Detroit 26, Mich.

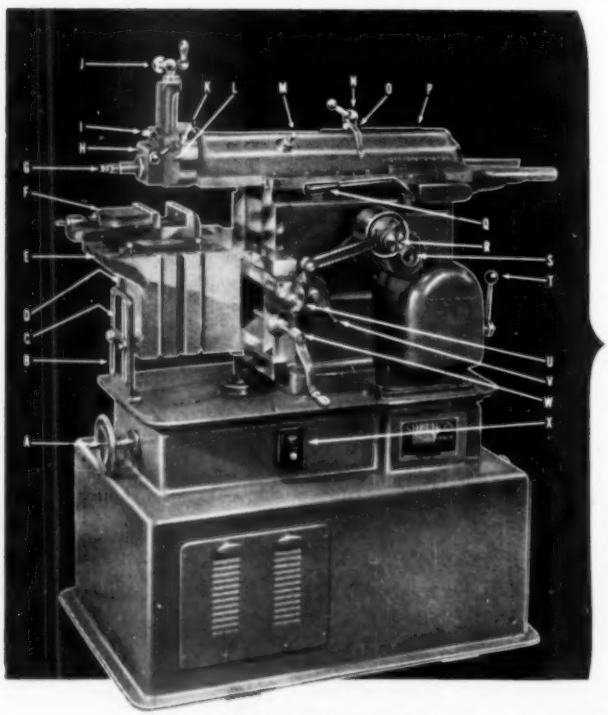
2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) American Society of Tool Engineers, Detroit, Mich., W. B. Peirce, Pittsburgh, Pa., I. F. Holland, W. Hartford, Conn., R. B. Douglas, Laval Sur Le Lac, Quebec, C. B. Cole, West Chicago, Ill., H. E. Collins, Houston, Tex., T. P. Orchard, New York, N. Y., A. J. Denis, Hollywood, Calif., A. M. Sargent, Detroit, Mich., A. M. Schmit, Toledo, Ohio, G. S. Wilcox, Jr., Detroit, Mich.

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state). None.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the twelve months preceding the date shown above is—(This information is required from daily publications only.)

Signature of editor, publisher, business manager, or owner. Robert B. Powers. Sworn to and subscribed before me this 1st day of October, 1947. Doris B. Pratt. My commission expires May 25, 1948.



SHELDON Vernon

No. 8000 12" Shaper

A	Variable Speed Hand Wheel	O	Stroke Indicator
B	Table Support	P	Ram
C	Table Protractor (not shown)	Q	Clutch
D	Cross Rail Lock	R	Feed Adjustment
E	Table	S	Shaft for Adjusting Length of Stroke
F	Vise	T	Back Gear Lever
G	Tool Holder	U	Cross Feed Screw
H	Clapper Box	V	Feed Direction Control
I	Clapper Box Lock	W	Elevating Shaft
J	Tool Slide Handle	X	Motor Switch
K	Tool Slide Lock		
L	Tool Slide Swivel Lock		
M	Ram Positioner		
N	Ram Clamp		

Here is a modern quality shaper you should know about. Write for Bulletin 547B.



Engineered to meet today's demand for close tolerance work at a wide range of speeds . . . for a compact, easy to operate shaper that is sturdy enough for production use, still accurate enough for the tool room . . . for a capable full sized (1800 lb.) shaper at a low price.

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CARBIDE-TIPPED TOOLS *with* HIGH-SPEED STEEL BODIES GIVE YOU 3 BIG *Advantages!*

1. Longer Tool Life
2. Smoother Operation
3. Reduced Production Costs

Carbide tips, it has long since been proven, increase the life of cutting tools tremendously. But when they are brazed on high-speed steel bodies, they give advantages even more important than longer life.

By providing a harder base for the carbide tips, they greatly reduce "spring-back" under heavy cuts, thereby making for faster and smoother operation.

Then too, the flutes and pilots do not score or pick-up because they Rockwell C-62-63 throughout their entire length, which means that the pilot gives much longer wear.

The final result, of course, is greatly reduced production costs—a vital consideration in these days of strenuous competition.

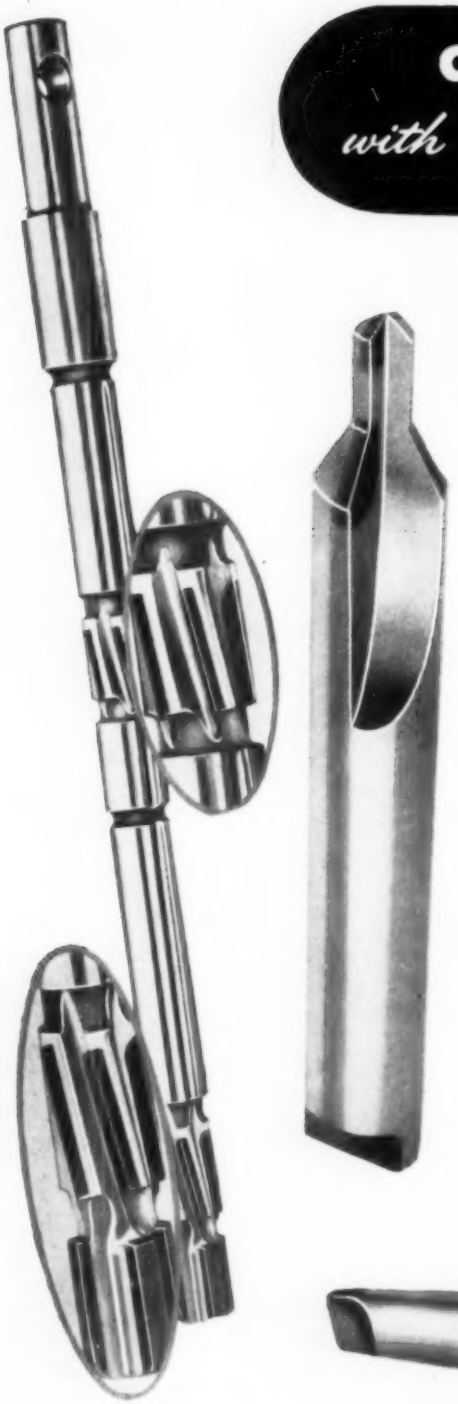
Our engineers will be glad to work with you on your problems

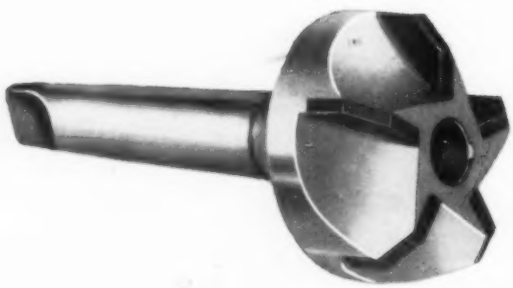
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REMOVE METAL *Fast*

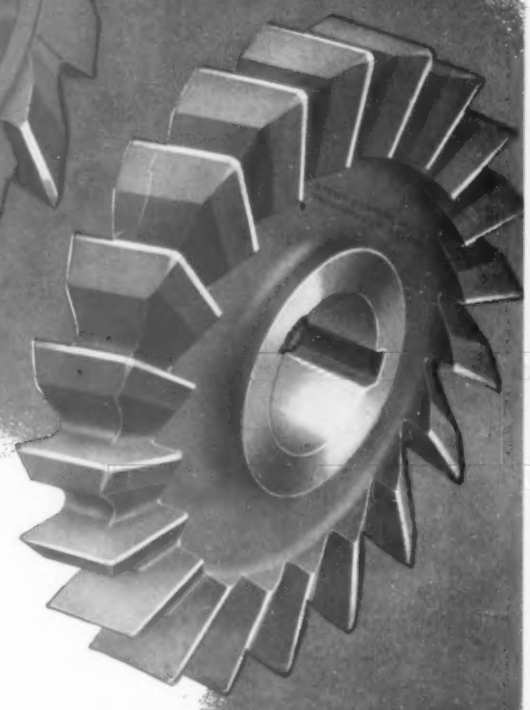
with these Brown & Sharpe Side Mills



SIDE MILLING CUTTERS
Frequently used in pairs for sizing nuts, bolt heads and similar work. Have cutting edges on both sides of teeth as well as periphery.



STAGGERED TOOTH SIDE MILLING CUTTER
Alternate right- and left-hand spiral angles with considerable angle of undercut permit these cutters to remove large amounts of metal without destructive vibration and chatter. Used in pairs as interlocking cutters.



HALF SIDE MILLING CUTTERS
Used for side cuts, on straddle milling or in cutting slots, where complete bottom finish isn't required. Spiral on lap and undercut on side give teeth improved cutting action.

PUT any one of these Brown & Sharpe Side Milling Cutters to work on a piece of metal and that metal will take shape quickly and accurately. In actual operation, you'll benefit by the inherent qualities of Brown & Sharpe design and craftsmanship that set the pace for all types of cutters.

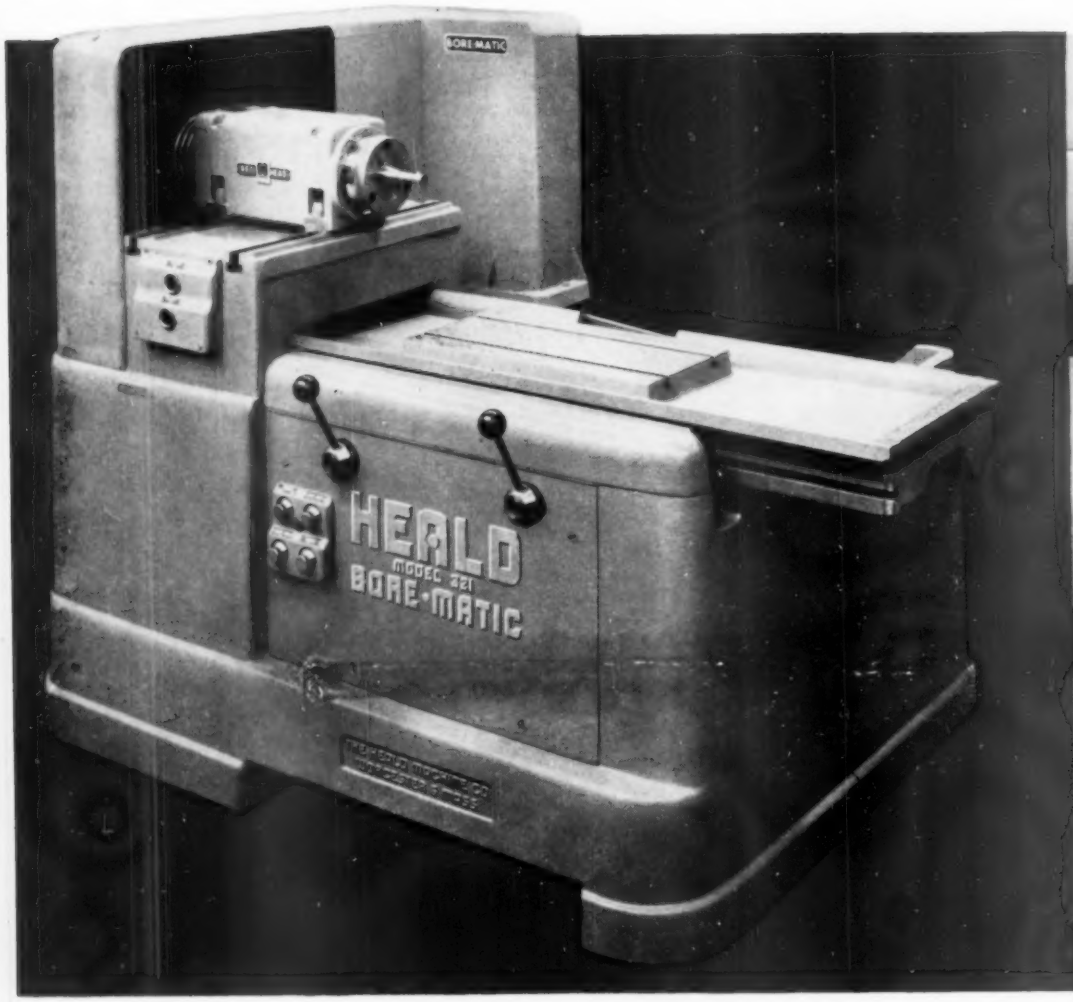
These side mills have clean-cutting qualities . . . ample chip space, carefully calculated rake angle, selected steels, scientific heat treatment individualized for each type of cutter, and expert sharpening. These are qualities that users have learned to expect in Brown & Sharpe Cutters. They're money-savers and production boosters because they combine to give unexcelled performance in speed, accuracy and more pieces per sharpening. Specify Brown & Sharpe when ordering cutters. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

We urge buying through the Distributor

BROWN & SHARPE CUTTERS B·S

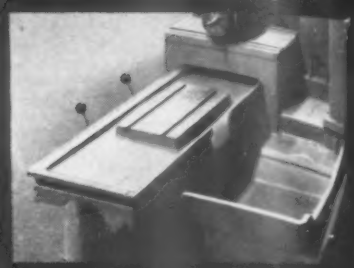
A NEW HEALD BORE-MATIC

FOR MEDIUM TO LARGE SIZE WORK

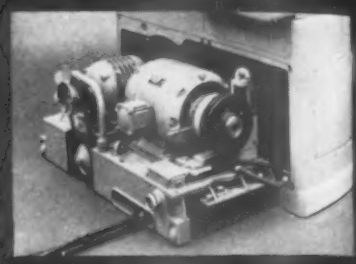




Centralized controls and adjustable table dogs



Large chip pan for chips and cutting fluid



Isolated power unit rolls out from base

Available in two sizes, either as a single-end or double-end machine

HERE IS THE NEW medium-large Heald Bore-Matic—an outstanding addition to your high-speed, mass production machining requirements. Handles a wide variety of work . . . in single or multiple machining operations . . . including rough and finish boring, turning, facing, chamfering, grooving, or fly cutting.

Below are a few important high-production, low-maintenance features of this new Heald Bore-Matic which serve to put it in a class by itself:

GREATER POWER for heavy roughing cuts and higher speeds for finishing on multiple heads.

EXTREMELY FAST OPERATING CYCLE with very high table traverse speeds, increased boringhead speeds, faster starting and quicker stopping of heads.

UNIFORM HYDRAULIC FEEDS remaining constant throughout the day regardless of oil temperature changes.

INSTANTANEOUS BRAKE TIMING saves boring time and tool wear.

TWO-WAY BORING available with different rates of "in" and "out" feeds by a simple control setting.

These and many other remarkable features make the new Heald Bore-Matic "tops" in production, "tops" in finish, "tops" in accuracy. Get further information at the Heald branch office nearest you, or write:

SEND FOR BULLETIN on new Heald No. 221-321 Single-End or No. 222-322 Double-End Bore-Matic. *Lists applications, features, specifications.*



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means more precision . . . less cost

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THE HEALD MACHINE COMPANY, Worcester 6, Mass.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

a pair of smooth operators



A pair of smooth operators, these Lovejoy Cutsall Milling Cutters are fast, free and easy in action. Designed especially for the most modern milling practices, Cutsall Cutters are big-bodied mills having rugged, tool-bit-type blades with extra large Carboloy Cemented Carbide tips.

The unusually large Carboloy insert allows deeper cuts, while adding considerably to blade life. Because they are built to run at high spindle speeds, continuously or intermittently, Lovejoy Cutsall Milling Cutters will remove the toughest stock at speeds you'll hardly believe —producing fine finishes of the closest accuracy.

*THE LOVEJOY "CUTSALL" CARBOLOY TIPPED TOOL-BIT-TYPE FACE MILL

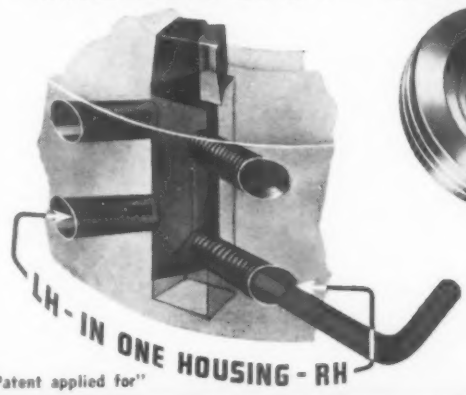


Lovejoy Cutsall Face and Step Mills have rigid, forged steel bodies designed to hold precisely and positively tool-bit-type blades. The blades, interchangeable among all sizes of Face and Step Mills for convenience and economy, can be ground easily to obtain positive or negative rake. In addition the blade design provides for fine individual adjustment and secure locking through two set screws in the housing.

Face mills are available in 6", 8", 10" and 12" sizes. Step Mills are available in same sizes as well as 4" dia. Both can be used for either right- or left-hand cutting.

For complete information on these powerful production tools, that will set new standards for speed and finish on your milling machines, send the coupon below.

*THE LOVEJOY "CUTSALL" CARBOLOY TIPPED TOOL-BIT-TYPE STEP MILL





On most jobs, and always when cutting steel, the use of a flywheel is recommended to insure most effective use of the carbide-tipped blades. Lovejoy manufactures a complete line of flywheels and will be pleased to assist you in picking the proper size for your particular job.

*"Patent applied for"

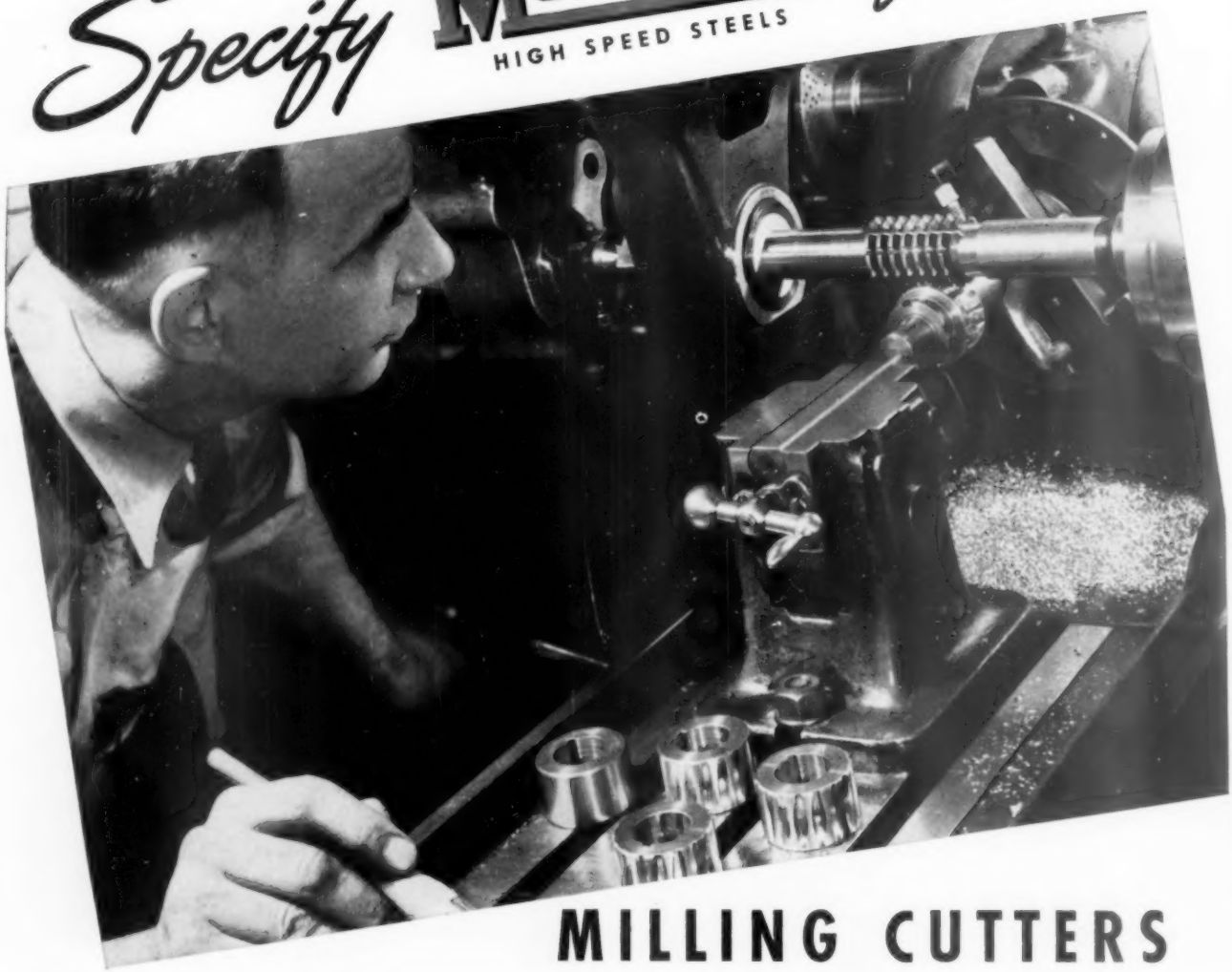
LOVEJOY TOOL CO., INC.
SPRINGFIELD, VERMONT, U. S. A.

Please send me full details of:
( ) Lovejoy Cutsall Mills
( ) Lovejoy Flywheels

NAME_____ TITLE_____
FIRM_____
STREET_____
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ON STANDARD OR "SPECIAL" SET-UPS

Specify MO-MAX HIGH SPEED STEELS *for your...*



MILLING CUTTERS

Only MO-MAX GIVES YOU ALL THESE ADVANTAGES

1. MO-MAX has superior cutting qualities.
2. The machinability of MO-MAX is unexcelled.
3. MO-MAX is economical. Its specific gravity is about 8% less than that of 18% tungsten steel.
4. MO-MAX is available in a standardized composition; also in cobalt and high vanadium varieties for special high speed steel requirements.
5. For 14 years MO-MAX has demonstrated its superiority in all types of cutting tools.

Learn all the facts! **Send for your copy of the MO-MAX Handbook, sixth edition. Get the full story about this remarkable steel, including easy-to-follow instructions on heat treating.**

THE CLEVELAND TWIST DRILL COMPANY

1248 East 49th Street • Cleveland 14, Ohio

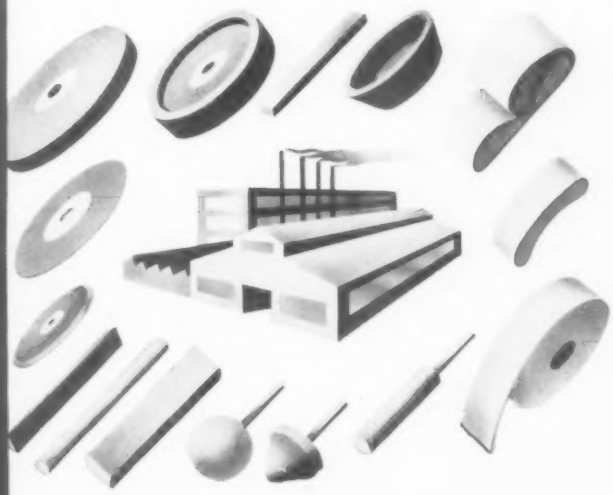
Buyer's Guide to Brands of MO-MAX

"LMW"	Allegheny Ludlum Steel Corporation
"MOHICAN"	Atlas Steels Limited
"BETHLEHEM HM"	Bethlehem Steel Company
"MO-CUT"	Braeburn Alloy Steel Corporation
"STAR MAX"	Carpenter Steel Company
"MOLITE M-1"	Columbia Tool Steel Company
"REX T-MO"	Crucible Steel Company of America
"DI-MOL"	Henry Disston & Sons, Inc.
"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
"MOGUL"	Jessop Steel Company
"TATMO"	Latrobe Electric Steel Company
"MIDMAX"	The Midvale Company
"S. T. M."	Simonds Saw & Steel Company
"MO-TUNG"	Universal-Cyclops Steel Corporation
"8-N-2"	Vanadium-Alloys Steel Company
"VUL-MO"	Vulcan Crucible Steel Company

A BUYING GUIDE FOR ABRASIVES

POINT No. 9

COMPLETE LINE OF ABRASIVES



The Carborundum Company makes the only complete line of abrasives produced under one trade mark.

With industrial techniques utilizing a wider variety of different type abrasives, it is only logical that users turn to The Carborundum Company as the one primary source for all abrasive needs. Product quality is known and highly regarded. Specialized service on all abrasive problems and applications is covered by experienced representatives who are free to recommend the best abrasive products for your requirements. Satisfaction is assured. Of even more importance to many, responsibility is definitely fixed and undivided. For reasons such as these, there is an increasing preference for products by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

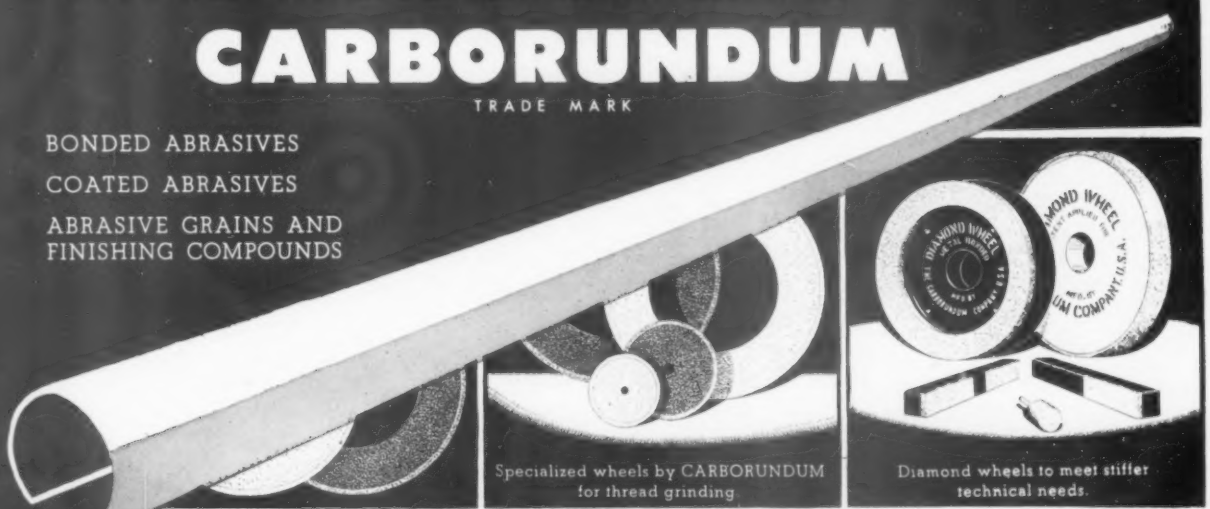
CARBORUNDUM

TRADE MARK

BONDED ABRASIVES

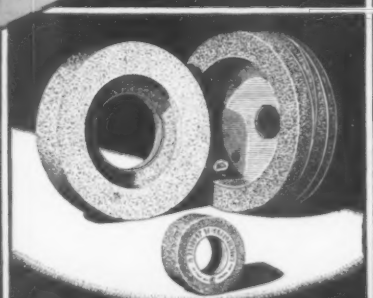
COATED ABRASIVES

ABRASIVE GRAINS AND FINISHING COMPOUNDS

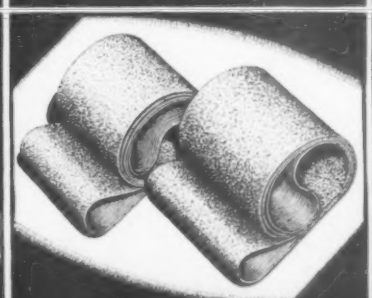


Specialized wheels by CARBORUNDUM for thread grinding.

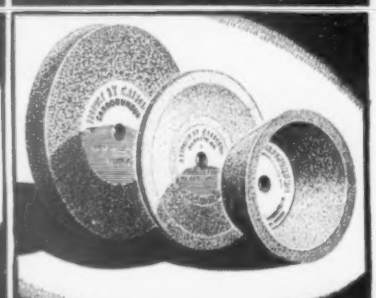
Diamond wheels to meet stiffer technical needs.



Cool-cutting green grit wheels for cemented carbide.



A coated abrasive for every sanding and finishing condition.

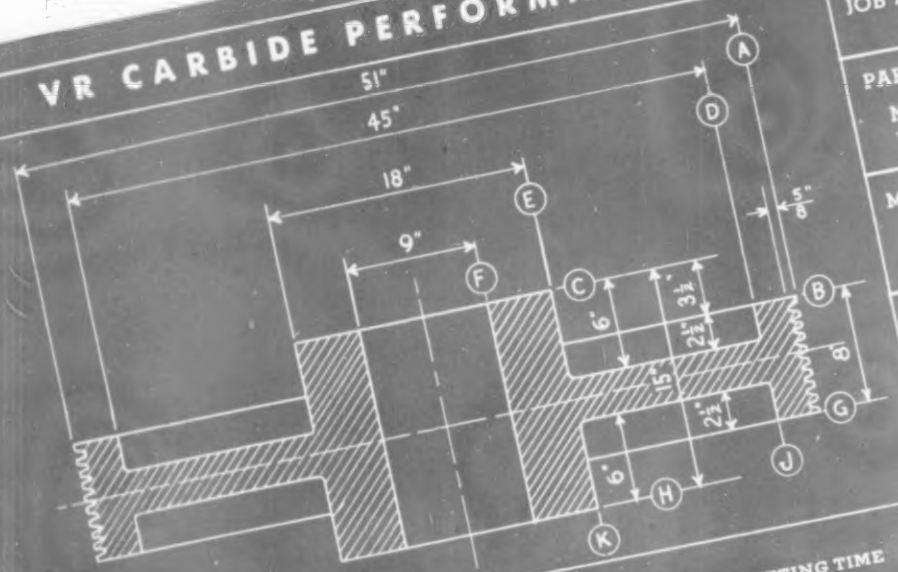


All standard shapes are supplied in grinding wheels by CARBORUNDUM.

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.

*V-R Carbide ... increased production 600%

VR CARBIDE PERFORMANCE DATA



JOB No.

PART: Nine groove sheave wheel—51" diameter.

MACHINE: Vertical Bullard 64" Cutmaster.

MATERIAL: Tough cast iron.

OPERATIONS: Roughing, finishing and forming Boring and facing.

REVISIONS

DETAILED OPERATION DATA:

SURFACES	S. F. M.	FEED	DEPTH OF CUT	LENGTH OF CUT	CUTTING TIME
A	250	.031	5/8", 3/4"	8"	16 minutes
B	250	.060	3/8"-1/2"	3"	
C	250	.060	"	4½"	
D	250	.060	"	2½"	
E	250	.030	1/8"-1/4"	6"	15 minutes
F (rough)	275	.030	"	15"	18 minutes
F (finish)	250	.021	3/8"-1/2"	15"	
9 grooves	250	.060	.040	160" (each)	11 minutes
G	250	.060	5/8"	3"	
H	250	.060	3/8"-1/2"	4½"	
J			"	2½"	
K			1/8"-1/4"	6"	

Comparative Analysis: Actual machining time with VR carbide . . . . 60 minutes
Actual machining time using high speed steel tools . . . . 10 HOURS
VR carbide tool life . . . . . 1½ to 2 pieces

MAKERS OF WORLD'S FINEST VR Carbides

SEND for your free copy of the NEW VR-400 Carbide Tool and Blank Catalog. 32-pages of vital carbide engineering information. Address Dept. TC547.

*Reg. U. S. Pat. Off.

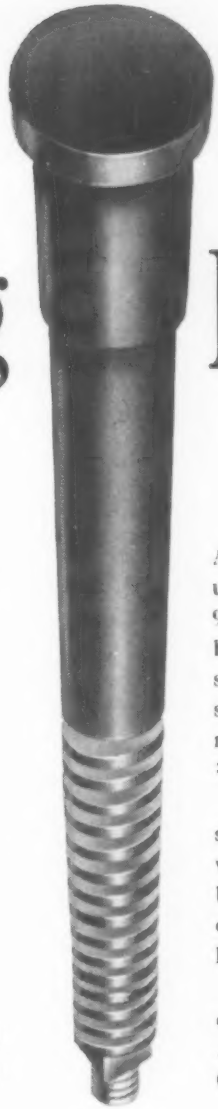


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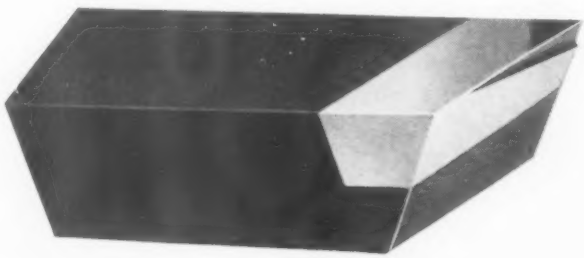
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Machining Monel?



This HAYNES STELLITE Tool has done a Job on Monel Valve Stems

Monel valve stems of various lengths and diameters are turned out faster with HAYNES STELLITE Tools.



A 1-in. square box tool, fabricated in the user's shop by brazing a HAYNES STELLITE 98M2 tip to a steel shank, does the combined rough- and finish-turning of valve stems made of cold-rolled Monel . . . at a speed of 557 r.p.m. . . . 240 surface ft. per min. . . . with a feed of 0.021 in. and a 3/8-in. depth of cut.

After 30 hours of use, the tool shows no sign of wear. The tool is ground to provide a 15-deg. side rake angle and a 15-deg. back rake angle; end and side relief angles of 6-deg.; a radius of 1/32 in. . . . and no lead angle.

Another HAYNES STELLITE tool subsequently cuts the acme thread at 297 r.p.m. . . . 72 surface ft. per min., with a cut of 0.020 in. per pass.

If you have a machining problem, a letter or phone call to our nearest office will bring a representative to tell you more about the effective use of HAYNES STELLITE cobalt-base alloy tools . . . on Monel, steel, cast iron, bronze, and other materials.

You can obtain more information about HAYNES STELLITE 98M2 tools by writing for the booklet, "HAYNES STELLITE Metal-Cutting Tools," Form 5401.

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Unit of Union Carbide and Carbon Corporation

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General Offices and Works, Kokomo, Indiana

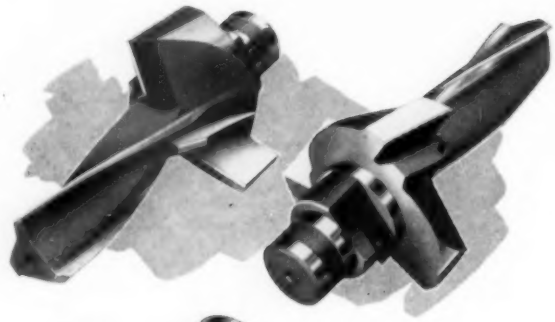
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The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

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3. Eclipse has the "know-how" to help you attain *increased production.*

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4 of 8 Kwick-Change Drill Heads at Kiekhaefer Corp.

KWICK-CHANGE *Multiple* Drill Heads

Step Up Production of Mercury Motors

At the Kiekhaefer Corp., Cedarburg, Wis., Kwick-Change, Multiple Drill Heads are employed on a variety of parts for Mercury Motors. They help keep production in step with demand. Both Adjustable and Fixed Center Heads are used. Kwick-Change Adjustable Multiple Drill Heads have locking templates to assure precision set-ups which "stay put." Each drill point readily located within a 3¾" circle, and all circles overlap. Each hole pattern has its own set of positioning and locking templates.

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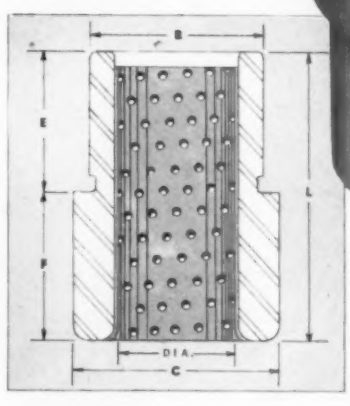
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NEW ➡ ➡ ➡ ➡ INDIUM BRONZE GUIDE PIN BUSHINGS



INCREASE ACCURATE LIFE OF DIE SETS

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Low Friction INDIUM BRONZE liner with indented spherical oil pockets reduces tendency of pins and bushings to seize and wear. Ask for Bulletin LB.

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It's a RIP saw!



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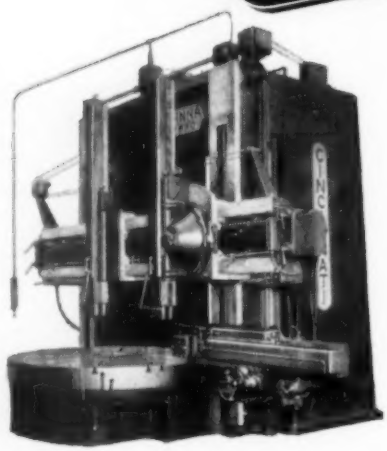
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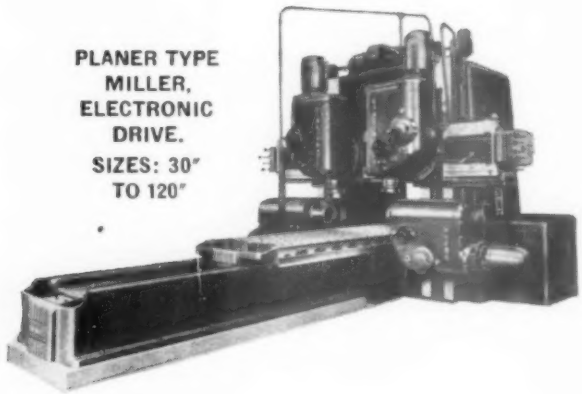
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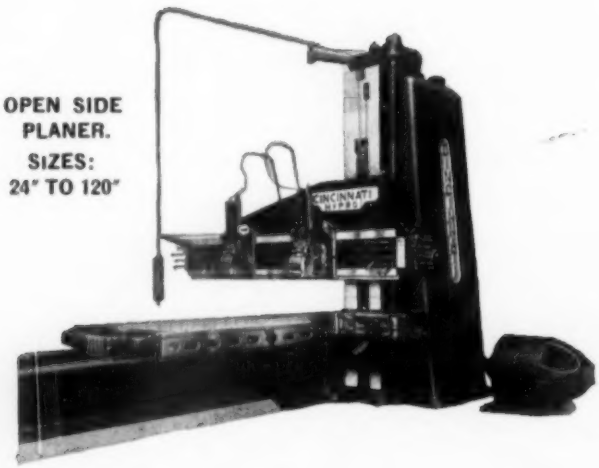
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SIZES: 54" TO 12'



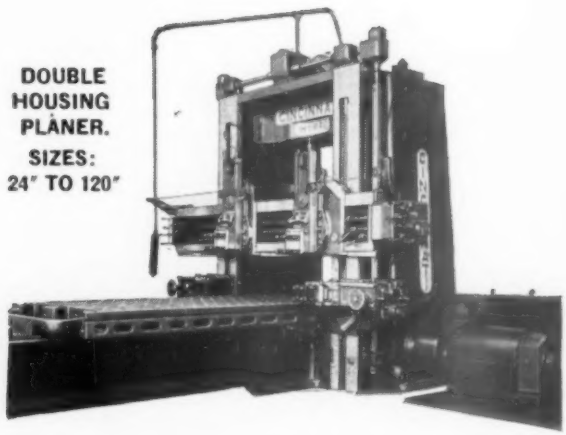
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SIZES: 30" TO 120"



OPEN SIDE PLANER.
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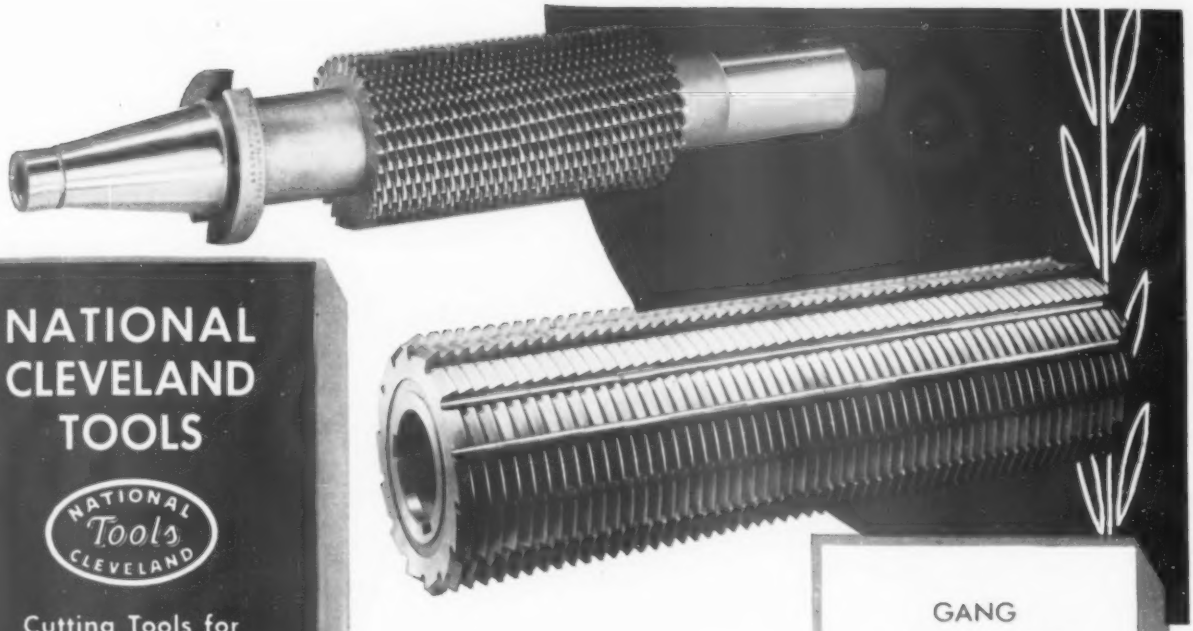
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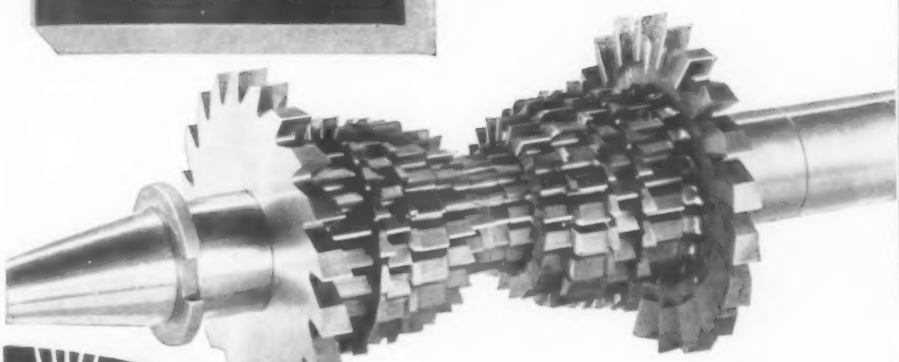
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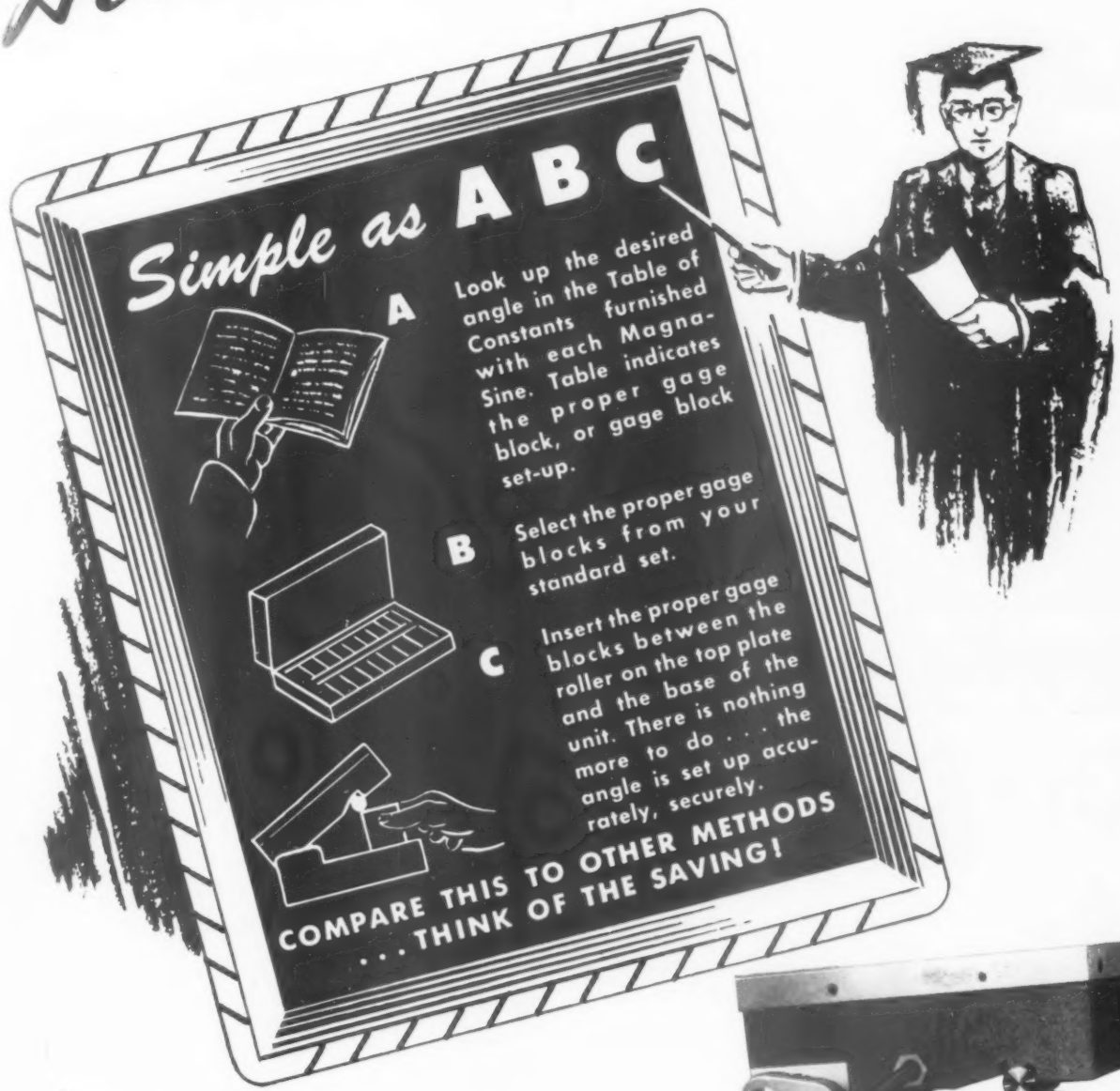
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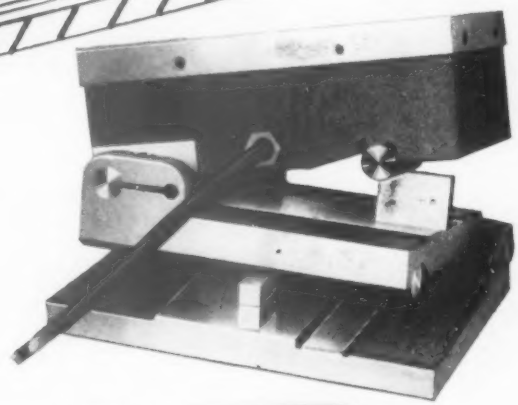
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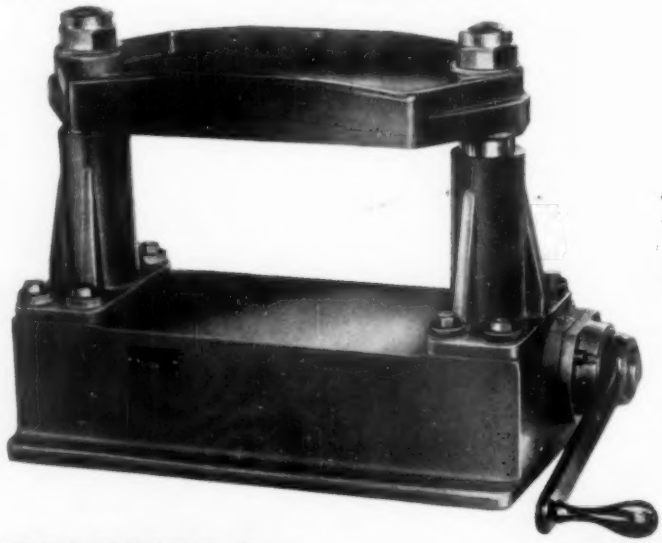
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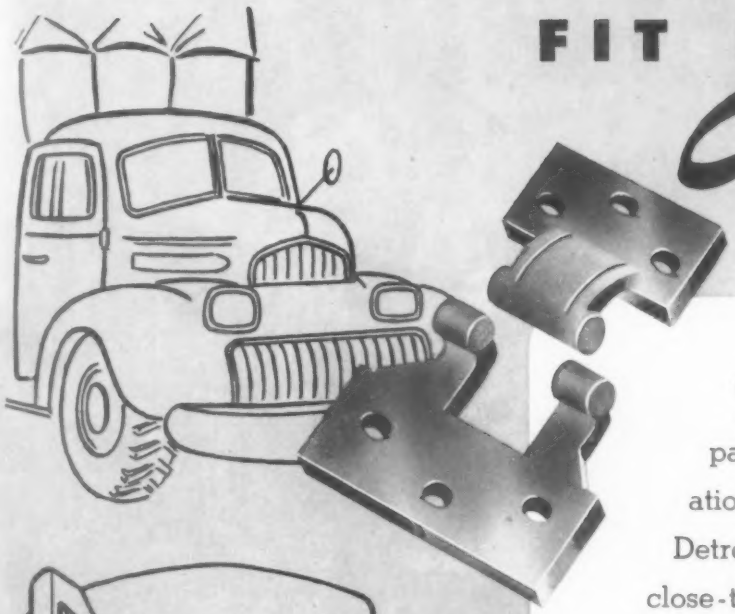
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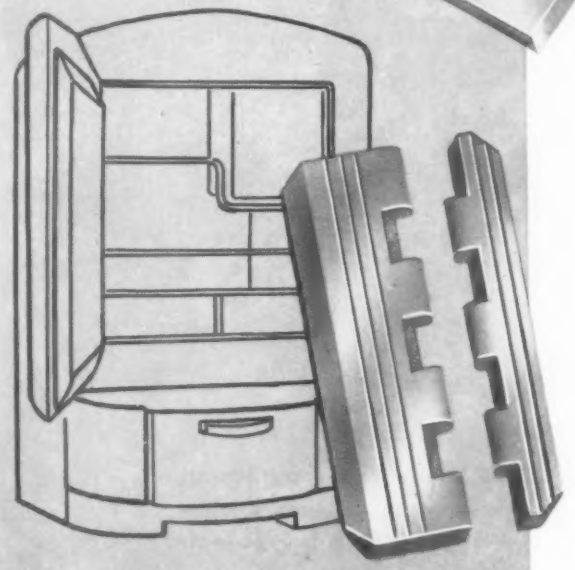
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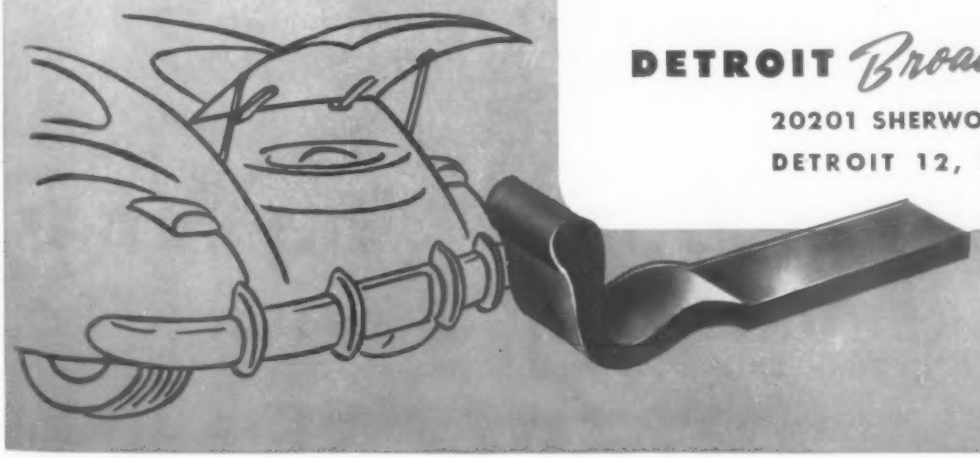
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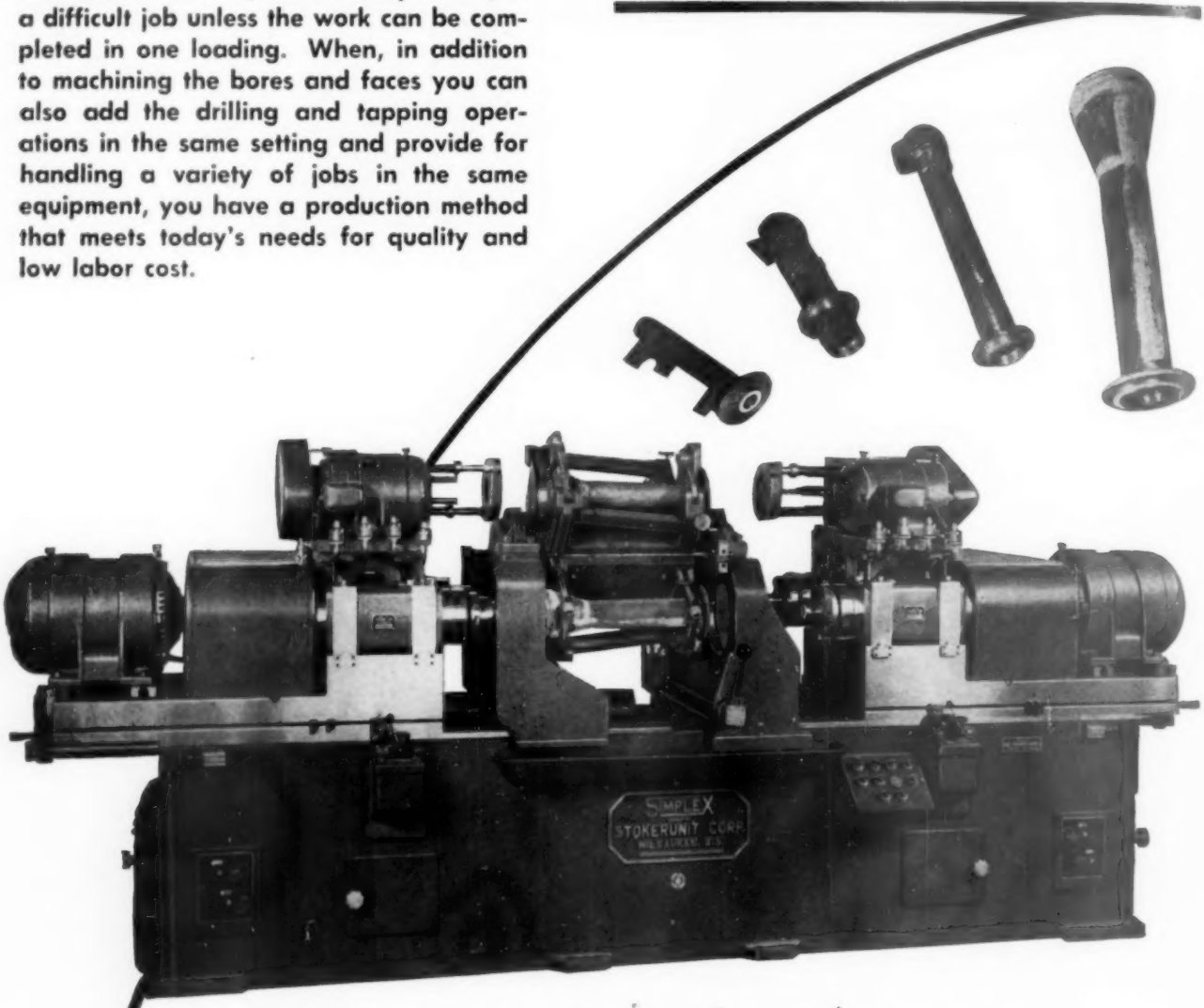
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The machine pictured is a SIMPLEX 4U 2-way Precision Boring Machine with four #4 spindles mounting combination boring and facing heads and also carrying unit type drilling heads with bushing plates for the drilling operation. By changing the fixtures, drills and boring tools, the various pieces illustrated can be handled with the same machine, thus this machine becomes in effect a production department in itself.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

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Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools



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Rigid tests under actual production have confirmed careful laboratory tests; this entirely new milling cutter has true one-piece rigidity under severe working conditions. Yet with all parts quickly and easily interchangeable, inventory costs and machine down-time are cut to an all-time low. Cutter bodies give full support to the entire projection of the blade, not only behind but also underneath.

The same blades are used for all sizes of cutter bodies. They are furnished diamond-ground to a gage, ready for work. They are made in three types, for cutting steel, for cast iron, and for non-ferrous materials. The assembled cutter need not be placed on a cutter grinder. The blades may be re-ground individually on an ordinary wet carbide grinder. When the cutter is set up in the machine, blades may be lined up against the cut in the work.

The same locks are used for all sizes of cutters. They are in one piece and remain attached to the cutter body when changing blades.

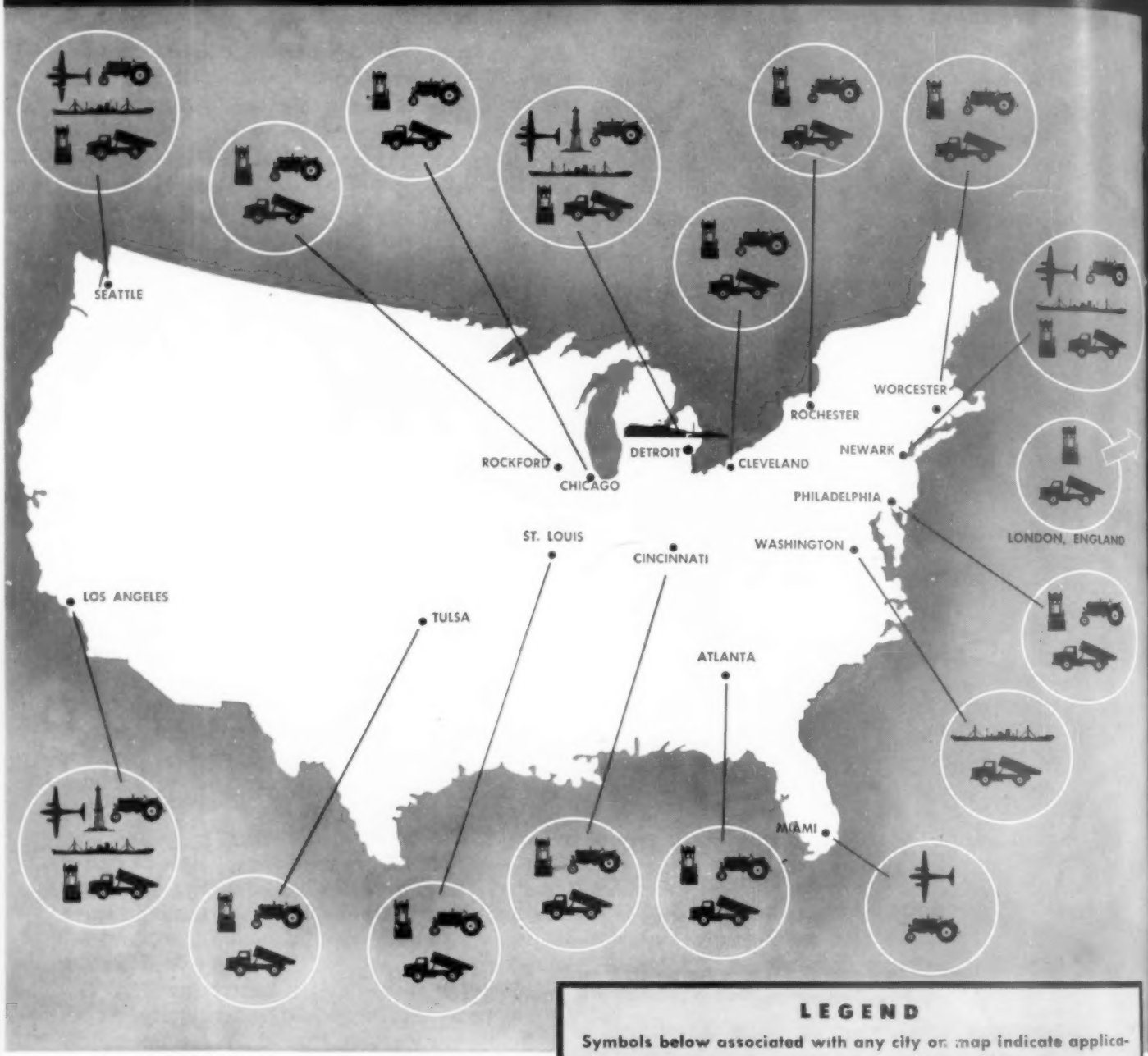
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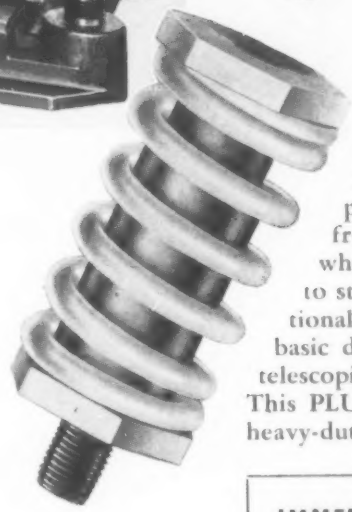


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~~WHEREBY~~ SIMPLER FOR
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CONVENTIONAL DIES THAN

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NEW, IMPROVED PATENTED STRIPPITS

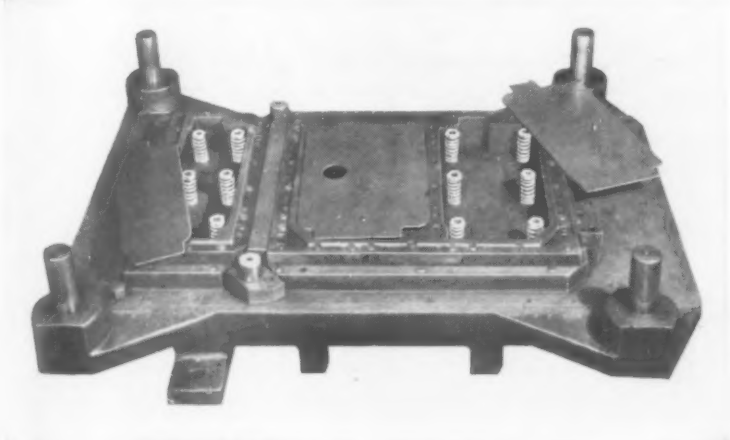




● Showing a blanking die equipped with Wales-Strippits. Note how the Strippits are uniformly located around the die shoe to provide equal stripping pressure over the entire work area. The simplicity of this die construction and the minimum number of parts is made possible only with Strippits. Blanked work is shown at rear of die.

● Strippits are as easy to install as a bolt. May be replaced in a couple of minutes to change stripping pressure without removing the die from the press. Strippits are used wherever spring pressures are required to strip the work or scrap from conventional blanking and forming dies. The basic design feature is a retainer which is telescopic, non-revolving and self-contained. This PLUS new redesign provides for extra heavy-duty usage.

● Showing punched out blanks on top of die. Note the Strippits hold the center blank elevated above the cutting edge of the die for easy, quick removal of the work from the die. By using Strippits, without stripper plates, binding of blanks against the inside of the die cutting edge is eliminated.



IMMEDIATE DELIVERY FROM STOCK

By ordering a trial quantity of Strippits today, you can see the savings in your plant tomorrow. They do so much at so little cost as shown below.

Cat. No.	Wire Size	Length	Travel	O. D.	Initial Load in Lbs.	Price Each
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2507	7/32″	2-1/2″	1/2″	1-5/16″	170	3.30
3007	7/32″	3″	3/4″	1-5/16″	140	3.40

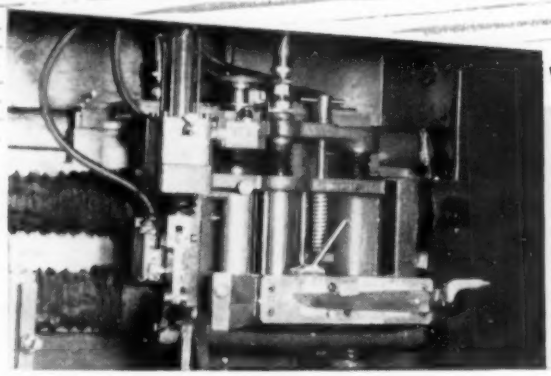
WITH WALES STRIPPITS no stripper plates are required...no springs to grind...no stripper bolts to make...no drilling and counterboring for stripper bolts...no boring of spring pockets...and no turning over of punch holder or die shoe after back sides have been planed...all machining is done from face side.

WALES-STRIPPIT CORPORATION
George F. Wales, President
393 Payne A nda, N.Y.
(Between Buffalo and Niagara Falls)

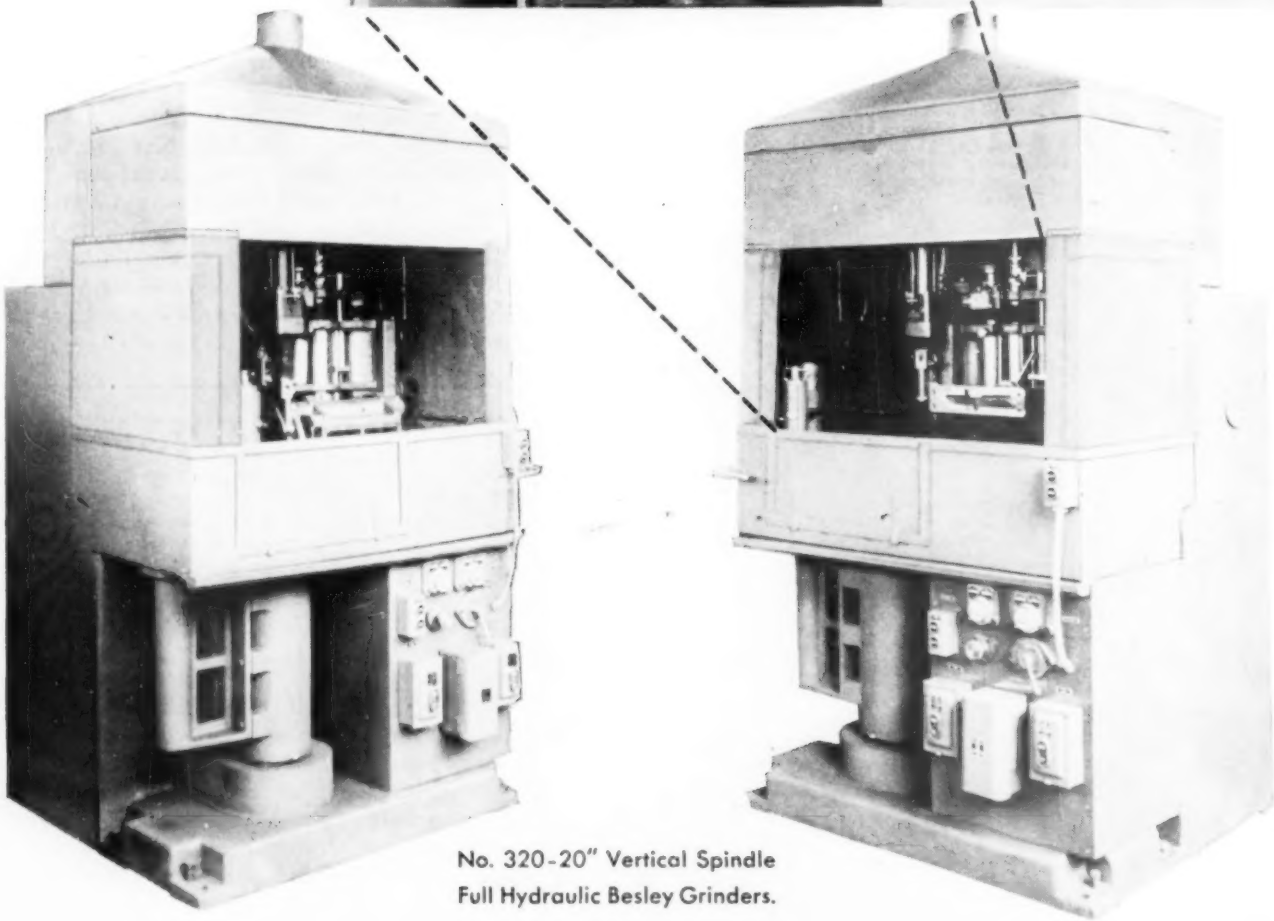
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Hedge shear forging in place in right hand machine, ready for grinding operations.



No. 320-20" Vertical Spindle
Full Hydraulic Besley Grinders.

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

Production Costs . . .

ON FLAT SURFACE GRINDING

BESLY GRINDERS

ONE OPERATOR USING TWO MACHINES NOW GRINDS UP TO 600 SURFACES PER HOUR

The most talked of equipment at the Machine Tool Show, these new Besly Grinders offer practical economies for many types of flat surface grinding. Used in pairs, as illustrated, they are equipped for grinding faces of hedge shears, wood chisels, plane bodies, cutlery, etc.

First, the operator places the rough forging in the fixture on the right hand machine. The fixture swings down into the horizontal position, reciprocates across face of grinding wheel—at the same time feeding down automatically. On reaching the micrometer stop screw, the work recedes from the grinding wheel and returns to the unloading and loading position.

The operator, whose normal position is between the two machines, takes the semi-finished forging from the right hand machine and repeats the operation on the opposite side of the forging using the second machine.

Oil is used as a coolant. The modern design of these machines makes it possible to control most of the mist.

The number of passes across the face of the grinding wheel and the speed at which the work passes back and forth across the wheel are readily controlled by the operator—also the hydraulic pressure and the speed of the down feed.

This work was formerly done by hand-operated machines of the single spindle type. Now, a single operator, using two of these machines, can grind 600 complete hedge shear forgings or 600 surfaces per hour.

By changing fixtures, these machines will also bevel grind hedge shears . . . and are adaptable to a large variety of flat surfaces—including wood chisels, plane bodies, combination square bodies, scissors, cutlery and similar flat surface units.

Perhaps grinders of this type will aid you to offset rising production costs. It will pay you to discuss the possibilities with a Besly engineer. Besly's 50 years of accumulated experience in answering grinding problems is yours to draw on. Write TODAY!

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CHARLES H. BESLY AND COMPANY • 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.



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SPECIFY LEHIGH DIE and TOOL STEEL *for SPLIT-HAIR JOBS*

Choose Lehigh H whenever the holding of accurate dimensions is a *must*. This high-carbon, high-chromium steel is engineered for minimum distortion during heat-treatment. It matches the highest skill of the master tool-and-die maker when tolerances must be slim.

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Lehigh H is one of the popular tool steels now stocked for quick shipment to mill customers from Bethlehem's Tool Steel Mill Depot. The nearest Bethlehem distributor or district office will give you full information about Lehigh H. And remember to call on Bethlehem for metallurgical advice when you have a tool steel problem.

Quick Facts

ABOUT LEHIGH H

Typical analys's:

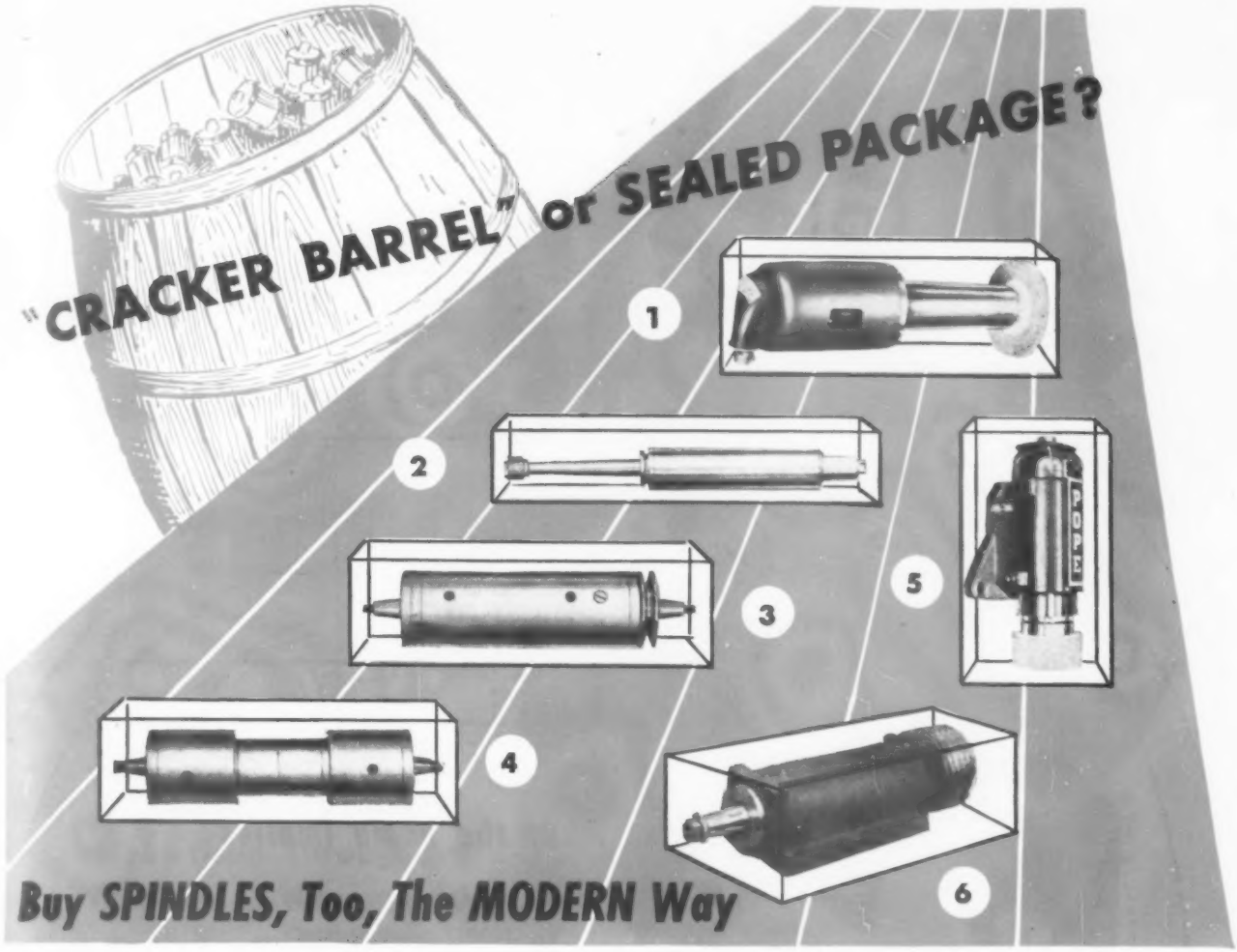
C	Mn	Si	Cr	V	Mo
1.55	0.35	0.40	11.50	0.40	0.80

Distortion-resistance—Very High
Abrasion-resistance—Very High
Machinability—Good
Shock-resistance—High
Working Hardness—58 to 64 (Rockwell C)
Hardenability—Hard surface with deep-hardening reinforcement. (Hardening in air insures safety, least amount of dimensional change.)

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL

LEHIGH H . . . one of Bethlehem's Fine Tool Steels



All These POPE PRECISION GRINDING SPINDLES Are *Sealed Lubrication, Sealed Package* Spindles

No. 1 is a POPE 6" x 18" Surface Grinder Spindle with *sealed-in* 1 HP motor and [illegible] double row, roller bearings. It produces superfine surface finishes and has the rugged ability to rough off surplus metal fast. Ask for Data Sheet No. 12.

No. 2 is an Internal Grinding Spindle — one of a wide range of sizes and speeds up to 35000 RPM. It produces accurate sized, better finished holes. Ask for Catalog No. 56.

No. 3 is a Tool and Cutter Grinder Spindle for Vee belt drive up to 6000 RPM. It fits standard grinders. Name your cutter and tool grinder and we'll send you an outline drawing.

No. 4 is a Double-Ended Tool and Cutter Grinder Spindle, belt driven with twin pulleys for two speeds from step pulley on motor. Speeds up tc 6000 RPM. Fits standard grinders. Name your cutter and tool grinder and we'll send you an outline drawing.

No. 5 is a Surface Grinder and Boring Mill Spindle. It comes with 3, 5 or 10 HP motor running at 1200, 1800 or 3600 RPM. Ask for Data Sheet Nos. 16, 17, 18, 19.

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These Modern, Sealed Package Spindles Are Now Available For Quick Delivery

No. 46

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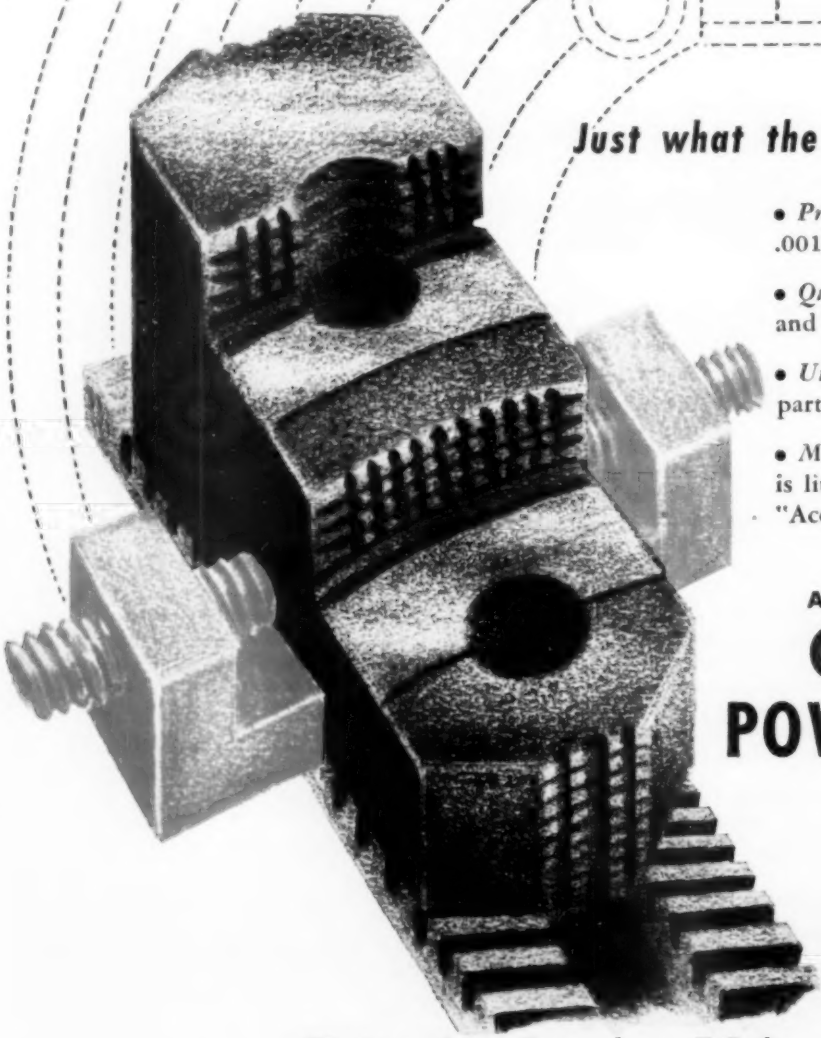
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Circumferences and Areas of Circles
Circles and Spheres
Squares and Polygons
Prime Numbers and Factors
Transposition of Formulas
Ratio and Proportion
Percentage
Interest
Alligation
Arithmetical and Geometrical Progressions
Positive and Negative Numbers
Preferred Numbers
Equations
The Slide-rule
Logarithms
Hyperbolic Logarithms
Calculation of Plane Figures
Calculation of Solids
Pappus or Guidinus Rules
Contents of Cylindrical Tank at any Level
Circles and Equivalent Squares
Solution of Triangles
Natural Trigonometric Functions
Logarithms of Trigonometrical Functions
Geometrical Propositions and Problems
Standard Mathematical Signs, or symbols
Standard Engineering Abbreviations
Standards for Drawings
Methods of Indicating Surface Finish
Composition and Resolution of Forces
Mechanical Powers
Center of Gravity
Moments of Inertia
Motion, Force and Work
Radius of Gyration
Centrifugal Force
Flywheels
Radians
Factors of Safety

Strength of Metals and Other Common Materials
Moments of Inertia Tables
Punch and Shear Frames
Section Moduli and Moments of Inertia
Properties of Shafts, Standard Pipe, and Structural Shapes
Beam Formulas
Structural Timbers
Strength of Columns
Strength of Flat Plates
Strength of Cylinders
Riveting and Riveted Joints
Wire and Sheet-Metal Gages
Wire Rope
Spring Design
Strength of Shafting
Friction
Design of Plain Bearings
Standard Ball and Roller Bearings
Lubricants
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Clutches and Couplings
Friction Brakes
Cams and Cam Design
Cam Milling
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Bevel, Spiral Bevel and Hypoid Gearing
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Helical Gearing
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Gear Measurement
Ratchet Gearing
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Chain Transmissions
Crane Chain and Hooks
Standard Bolts and Nuts
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Standard Set-screws
Wood Screws, Nails, Spikes

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Measuring Screw Threads
Allowances and Tolerances for Plain Fits
Standard Allowances and Tolerances for Screw Threads
Measuring Tapers and Angles
Rules and Constants for Setting Sine-bars
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Thread Milling
Thread Grinding
Thread Rolling
Change Gears for Helical Milling
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Milling Cutters
Cutter Grinding
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Punches and Dies
Broaches and Broaching
Files
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Jigs and Fixtures
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Cutting Fluids
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Tool and Structural Steels
Hardness Testing
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Forging—Welding
Soldering, Brazing
Heat-treatment of Steel
Compositions of Alloys
Coloring Metals
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Part is a tread pin, 18 in. long by 1⅝-in. dia. Material is SAE-1045 cold-rolled steel. Requirements are 50-55 Rockwell "C" at surface, ⅛-in. depth of case, without changing core structure.

Manufacturer is
U. S. AXLE CO.,
Pottstown, Pa.



ONE 18" PIN EVERY 3 MIN.

SURFACE HARDENED TO 52 R "C" by High-Frequency Heating

This tread pin is an example of one advantage of high-frequency heating—obtaining a uniformly hard surface and ductile core without resorting to alloy steel or carburizing.

Pins are progressively surface hardened to 1/8-inch depth at 6 inches per minute while rotated at 30 rpm. Surface is heated to 1550°F and immediately water quenched.

A surface hardness of 52 to 55 Rockwell "C" is obtained, while core remains at approximately 20. Warpage, over the 18 inches, is 1/32 inch or less. No finishing is required because of negligible scale. Working conditions are clean and cool, and since operation is automatic, an unskilled operator can produce excellent and uniform results.

The heating coil was developed by Lepel Laboratories for use with a 30-kw spark-gap converter. Manufacturer developed the motor-driven carriage, mounted on a Lepel quench tank, which provides the progressive feeding and rotation of the pin.

SOLDERING
BRAZING
HARDENING
ANNEALING
MELTING

The same Lepel Spark-gap Converter will handle any or all of these processes, usually with advantages similar to those given in this advertisement. Often this unit will prove substantially more economical than any other high-frequency generator—*particularly when heating non-ferrous or non-magnetic materials.* Changing from one job to another can be done in less than 5 minutes.

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Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

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One of the most common causes of oversize and bell-mouthed holes in tapping and reaming is carelessness in lining up the spindle with the work.

Such carelessness is no longer serious, however—because, by using a Ziegler Floating Holder which automatically compensates for spindle misalignment of as much as 1/32" radius or 1/16" diameter, work can still be turned out to the finest tolerances in spite of inaccurate set-up.

Instead of writing off spoilage losses day after day on tapping and reaming jobs, why not put an end to them by changing over to Ziegler Floating Holders? You'll find that they'll repay their cost in a remarkably short time.

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Ziegler ROLLER DRIVE **FLOATING HOLDER** for Taps and Reamers...



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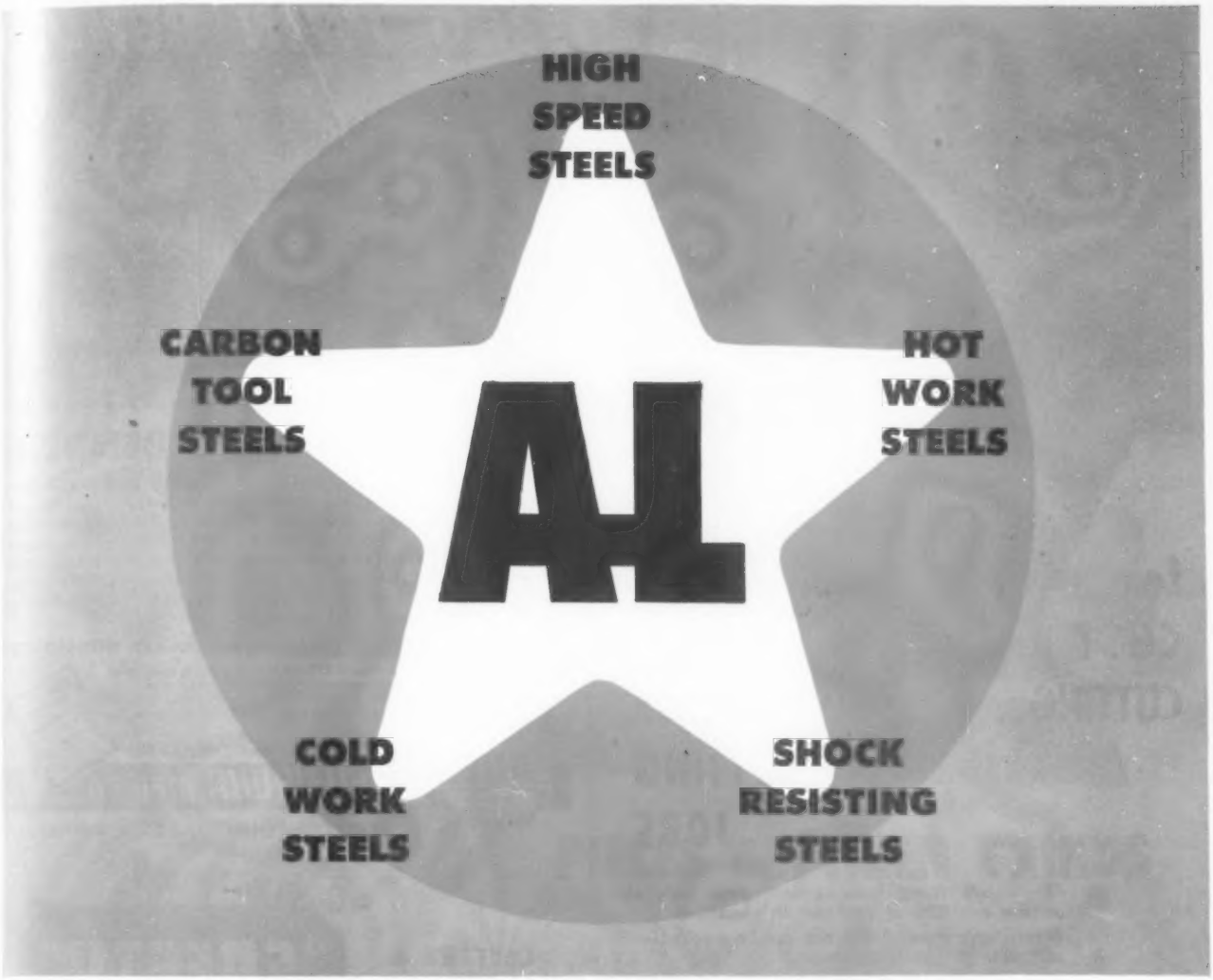
IN THE TOOL ROOM ... IN PRODUCTION

Boyar-Schultz Profile Grinders save time in grinding inside and outside contours, irregularly shaped profiles, die clearances and many other difficult grinding tasks.

Boyar-Schultz No. 2 Profile Grinder—A heavy duty floor model available with single or dual spindles which turn at 10,000 R.P.M. with vertical oscillations. Rapid stock removal even with wheels as small as ½" diameter. Uses wheels ½" to 3".

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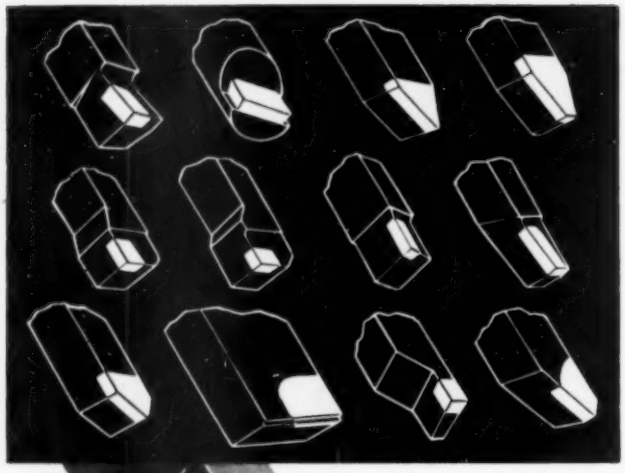
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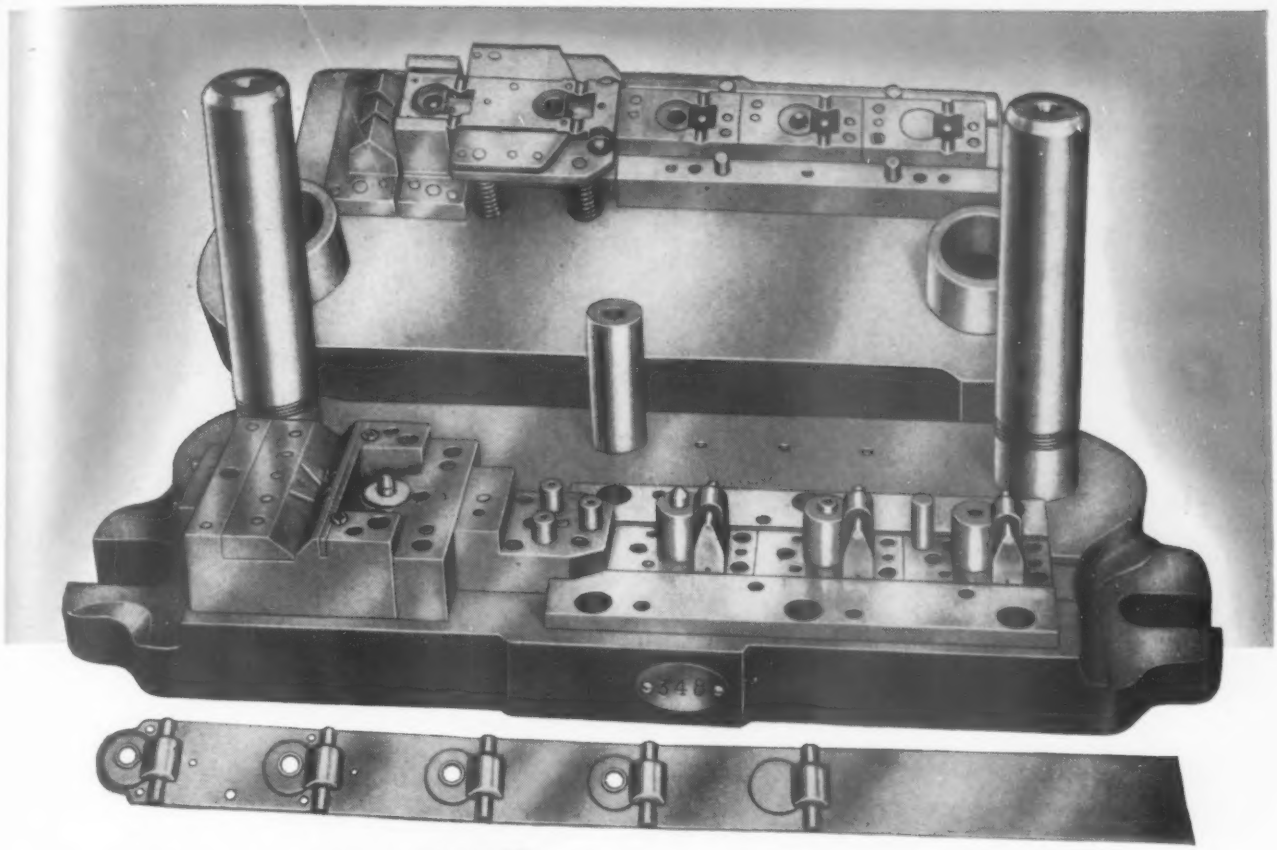


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These parts were made with a Cromovan six station punch and die from .032 cold rolled coils on slide feed fully automatic press. They were produced by Publix Metal Products, Inc., N. Y.

This CROMOVAN DIE was used in the production of housings for the tilt mechanism of venetian blind hardware. Its performance attests again the high quality and desirable characteristics of Cromovan die steel for high production, accuracy and unusually long life.

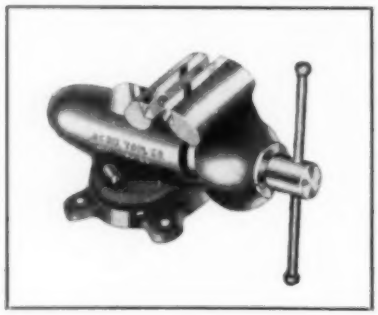
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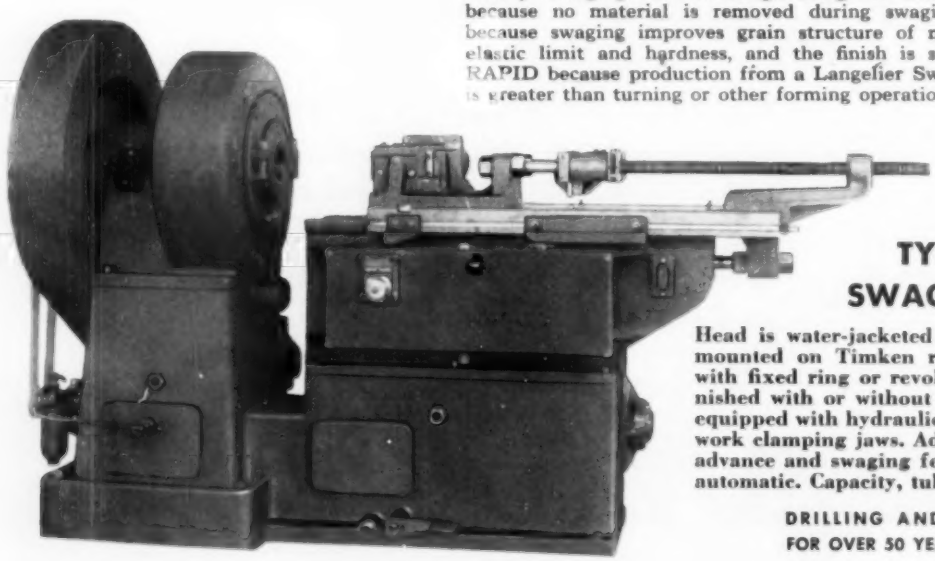
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Rotary Swaging on new-design Langelier Swaging Machines is ECONOMICAL because no material is removed during swaging operation . . . . PRACTICAL because swaging improves grain structure of metal, increases its tensile strength, elastic limit and hardness, and the finish is smooth, to size, and straight . . . . RAPID because production from a Langelier Swaging Machine in almost every case is greater than turning or other forming operations. Timken-mounted spindle reduces power consumption, lengthens life of parts, and provides close concentricity between revolving spindle and circle of head rolls. Investigate!

TYPE D and E SWAGING MACHINE

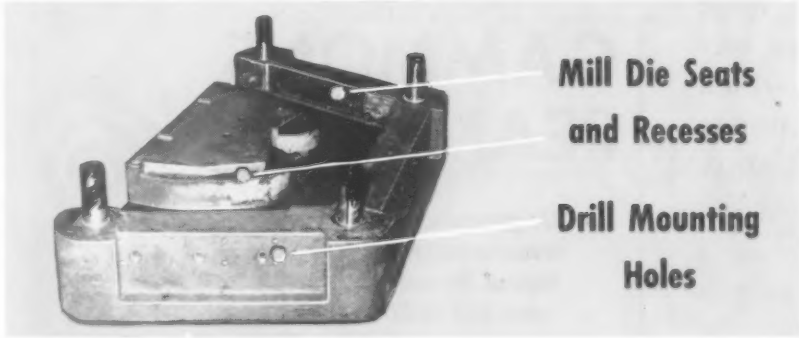
Head is water-jacketed for hot or cold swaging. Spindle mounted on Timken roller bearings. Head construction with fixed ring or revolving cage is optional. Can be furnished with or without holder. Machine as shown here is equipped with hydraulic feeding mechanism and hydraulic work clamping jaws. Adjustable dogs vary length of quick advance and swaging feed to suit requirements. Return is automatic. Capacity, tubing: Type D, 1⅛". Type E, 1½."

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FOR OVER 50 YEARS . . . INCORPORATED 1887

LANGELIER MANUFACTURING COMPANY, PROVIDENCE, RHODE ISLAND



DANLY Special Die Sets — *Ready for mounting the Dies on Specification*

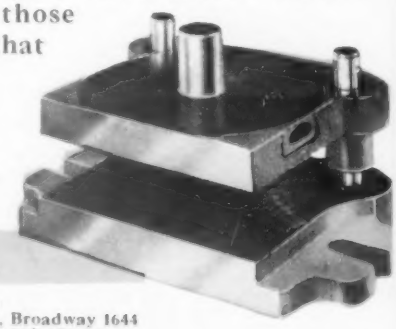


"Mill die seats and recesses; drill mounting holes; mill mounting pads." The work performed on the set shown here is an example of the machining operations that Danly can do for you while your die set is in process. In many cases this necessary machining can be done on the same setup as standard operations on the die set, thereby minimizing setup and handling time.

Additional machining may be specified on any "special" including M-K and A-S sets which can be ordered directly from the Danly Catalog.

This Danly service is especially valuable on large sets. Milling, drilling and boring operations, so easily handled here may cause difficulty in the die shop or your own tool room where equipment is not specifically suited to large work.

Investigate this time saving and cost cutting service. On your next special die set order consider Danly's service for those "extra" operations that can be handled here. Your die set will be delivered "ready for mounting the dies."



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Los Angeles 54, California, Kimball 0181

DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

That Unseen Extra Quality



Drunken Threads?

Republic's thread plugs are checked on a specially built instrument known as the drunken lead checker, which reads directly to .0001. "Drunkenness" in setting plugs makes proper adjusting of the rings almost impossible as a "jump" will be noted as the ring is set to the master.

Republic's gages with "THAT UNSEEN EXTRA QUALITY" cost no more.

RELY ON REPUBLIC

REPUBLIC GAGE

DETROIT 21, MICHIGAN



Is HEAVY OVERHEAD Increasing the COST of your FINISHED PRODUCT?

LET us help you reduce your finished product costs.

BECAUSE our shop is exceptionally well equipped and manned we can give you rapid precision production at an economical cost.

ANDERSONS, INC., is now machining production parts for manufacturers of farm equipment, aircraft components, communication and automotive equipment, machine tools, and food machinery. Send us your inquiries on production machining. They will receive prompt, efficient service.

MANUFACTURING FACILITIES INCLUDE THE FOLLOWING MACHINES AVAILABLE FOR PRODUCTION:

GRINDING—Blanchard Grinders; Horizontal Surface Grinders; Internal Grinders; Cylindrical Grinders; Centerless Grinders; Tool Grinders.

MACHINING—Engine Lathes; Shaper; Doall Band Saw; Drill Presses; Tapping Machines; Bench Lathes; Turret Lathes; Hand and Universal Milling Machines; Rockwell Testing and Precision Measuring Equipment.

Andersons, Inc.

2325 NELSON ST., CHICAGO 18, ILL.

GAMMONS REAMERS★

Originators and Manufacturers of Helical Reamers and End Mills



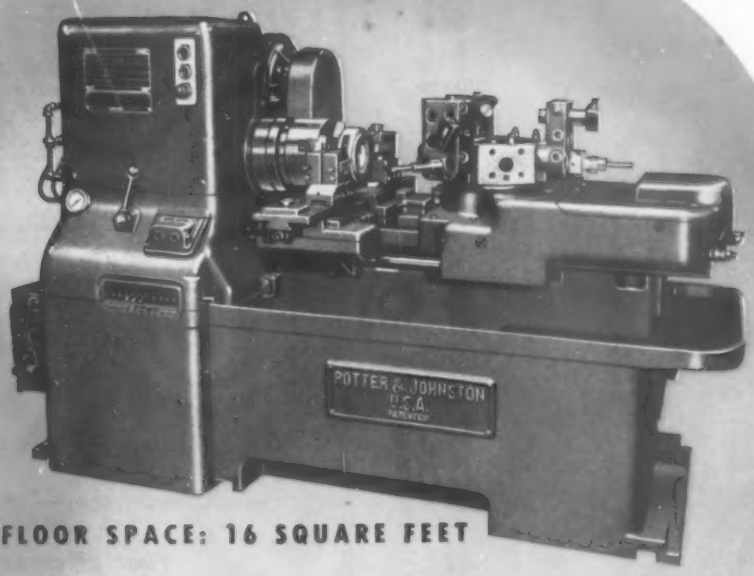
Helical Taper Pin Reamers Shipped by Return Mail

The

GAMMONS-HOAGLUND

Company

400 MAIN STREET, MANCHESTER, CONN.



FLOOR SPACE: 16 SQUARE FEET

The question behind any automatic lathe is:

can it increase production at lower unit cost?

With the **3-U** *Automatic Turret Lathe, we say "Yes!"*

Greatly increased hourly pay of machine operators upsets time study men and shakes up cost accounting. One method whereby operations can be profitably balanced is to use a machine that INCREASES PRODUCTION AT A LOWER UNIT COST. P. & J. Automatic Turret Lathe, newest addition to a long line of automatics designed for profitable production, is built to give the HIGHEST PRODUCTION PER OPERATOR. Known as the 3-U Automatic Chucking and Turning Machine, it is another demonstration of superiority over hand machines, both as regards to the quality of the finished product and increased output, as well as to a corresponding reduction in the labor costs for producing the work. There are 48 changes of speed between 36-711 RPM and 73-1445 RPM. These speeds are arranged in six sets of four automatic changes. The feed gearing is driven from the spindle, causing the feeds to vary directly with the spindle speed.

There are 24 feeds arranged in geometric progression, and there are three automatic variations of feed. The P. & J. 3-U Automatic is not an experiment: it is a full-fledged member of the P. & J. line of automatics, already living up to its manufacturers' claims on the industrial firing line.

P&J

Potter & Johnston Machine Co., Pawtucket, R. I.

Just What the Name Implies!
"SURE-CLAMP" Drill Jigs

This inexpensive "Q-C" Unit incorporates positive clamping of work, plus ¼" follow-up to care for variations of part.

Any desired clamping pressure.

Get the facts about the SURE-CLAMP drill jig and other "Q-C" Units including: Standardized Jigs, Fixtures, Rotary & Rectangular Index Tables, Fixture Units, Locating Pins and Rest Buttons, etc. Ask for our "Q-C Tool Engineers Reference & Standards Book"—gratis.

A few desirable territories open to Live-Wire representation.

Q-C Engineering Products

2842 W. GRAND BLVD. — DETROIT 2, MICH. — TR. 1-4400

TO STANDARDIZE IS TO ECONOMIZE

SURE-CLAMP Drill Jig

14 Sizes; from 4"x5" to 9"x30" Right or Left Hand Operation. Posts may be used as Guide Bars with Drill Head.

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates

Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303D North 11th St., St. Louis 6, Mo.
In Canada: 2466 Dundas St. West, Toronto, Ont.

Free Lance Writer, Editor, Planner

Good technical copy—"ghost" or "regular"

Your office or mine.

C. F. WORFOLK Algonac, Mich.

(Algonac is near Detroit)

Proof of LOWER PRODUCTION COSTS with REED Triple-Die *Precision Thread Rolling!*

1920 PIECES AN HOUR

Part: SPARK PLUG SHELL

Thread: 14mm x 1.25mm

Material: SAE 1315 STEEL

Rolled on the **REED Cylindrical-Die THREAD ROLLER Model A22**

For complete specifications, write for Bulletin A22-1.

REED ROLLED THREAD DIE CO.
Worcester 2, Mass., U. S. A.

REED

Knurls — Thread Rolling Dies and Machines

Formerly ROLLED THREAD DIE CO. *and* REED SMALL TOOL WORKS

PRICES REDUCED!

ON THESE SCULLY-JONES CENTERS

SOLID HIGH-SPEED STEEL CENTERS REDUCED 48%

CARBON STEEL CENTERS REDUCED 32%



Now you can buy the famous Scully-Jones precision-built, true-running, long-life centers for about One-Half to Two-Thirds of the former prices!

All Scully-Jones Centers, from the smallest to the largest, are ground to a concentricity of .0002". Furnished in Morse, Brown & Sharpe, and Jarno Tapers.

Scully-Jones Solid High-Speed Steel Centers are made from Tungsten H. S. Steel, (18-4-1 analysis) heat-treated to 63-64 Rockwell "C". Now priced comparable to centers that have only high-speed steel points with tool-steel shanks.

Equip your Lathes, Grinders or Special Machinery with these centers at Reduced Prices.

OTHER SCULLY-JONES CENTERS—(1) Solid High-Speed Steel Half Centers. (2) Stellite-Tipped Centers. (3) Tungsten Carbide-Tipped Centers. (4) Special Centers made to your requirements.

For complete information refer to pages 302-307 of Scully-Jones Engineering Manual 500, or write for a list of tapers at these reduced prices.

ARE YOU PLANNING

Send us your drawings and specifications. We will quote promptly and can meet early delivery dates, thus preventing delays in your production schedule.

FREE Valuable Chart, showing Safe Work Load for Centers. Write today for your FREE copy; no obligation.

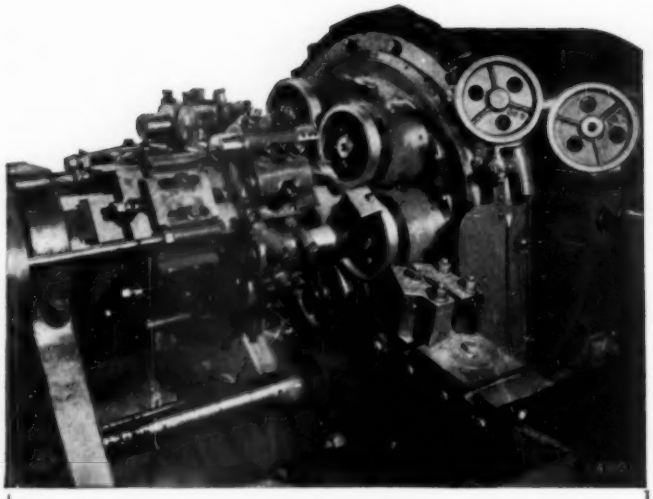
Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

IMMEDIATE DELIVERY!

ON ALL POPULAR SIZES

Scully-Jones AND COMPANY

1915 SOUTH ROCKWELL ST., CHICAGO 8, U.S.A.



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

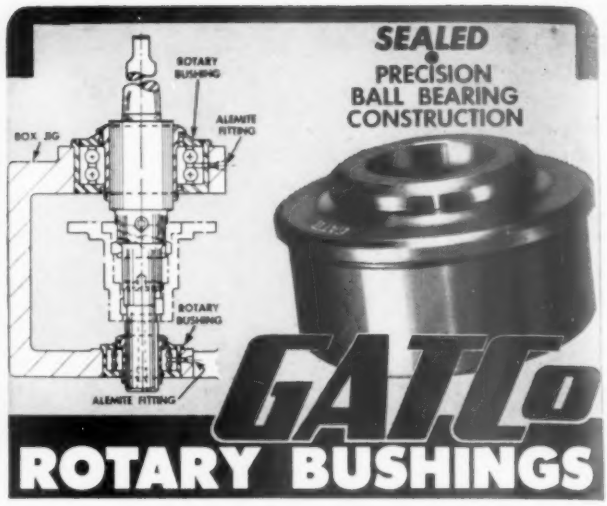
This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.



FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

GIERN & ANHOLTT TOOL CO.
1302 Mt. Elliott Avenue • Detroit 7, Michigan



MARVEL No. 18—18" x 18" MARVEL No. 24—24" x 24"

Designed and developed to bring true accuracy and economy to sawing big work up to 24" x 24". In hundreds of metal working plants from coast to coast, these giant saws have proven themselves to be the best cut-off equipment for the biggest and toughest steels. There are nine other types of MARVEL saws to meet every sawing need. Write for our catalog and give us an outline of your work. We will recommend the right MARVEL saw for your work.

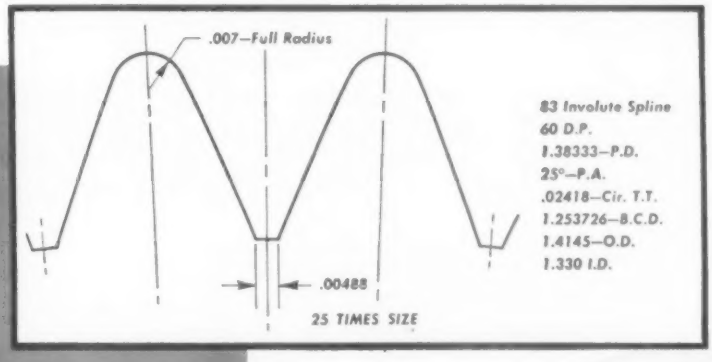
MARVEL *Metal Cutting* **SAWS**
Better Machines-Better Blades

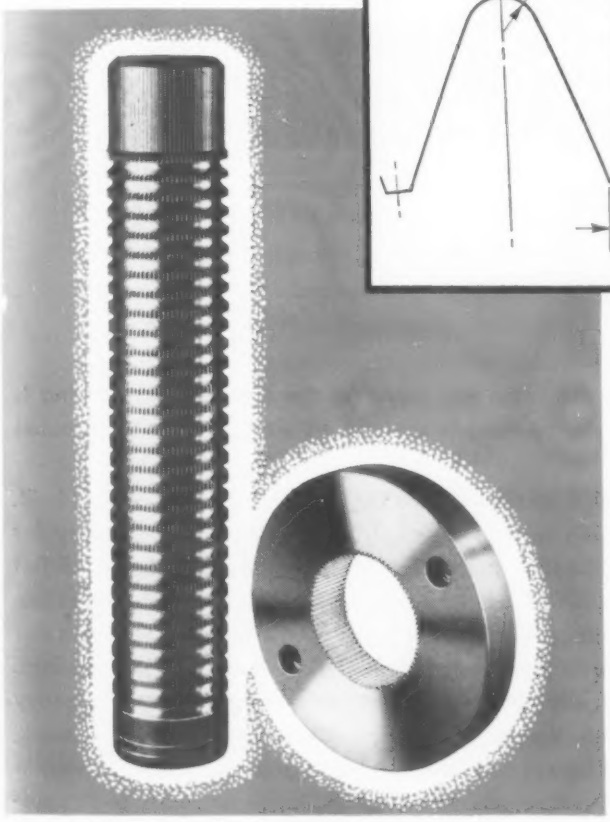
ARMSTRONG-BLUM MFG. CO.
"The Hack Saw People"
5700 Bloomingdale Ave. Chicago 39, U.S.A.

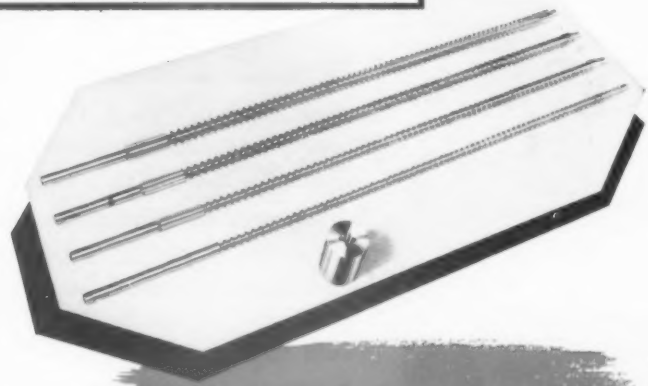
ART AND SCIENCE *Unite* IN MAKING *SUCCESSFUL NALOY BROACHES*

The broach engineer, from long experience, determines the design and the machining cycle in which the broach is to be used. The craftsmen using the most modern equipment put that design into steel.

Here are two highly successful Red Ring broach projects. The first is a fine pitch involute form broach to make the shaving dies for the gear teeth of a camera shutter lever winder. Tolerances on involute form, tooth spacing, tangent radius on top of gear teeth and width of space at minor diameter were held to a tolerance of less than .0002". The second project is a set of broaches used to produce the tooling for a cycloidal gear tooth pump. Here, four broaches are used because of the length of the part and the amount of metal that had to be removed.







Red Ring broach engineers have had 17 years of experience in handling all types of problems. Take advantage of this experience.

2625

RED RING PRODUCTS

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE • ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

Logan A NAME TO REMEMBER

WHEN YOU THINK OF better LATHES AND SHAPERS



Quick Change Gear Cabinet Lathe

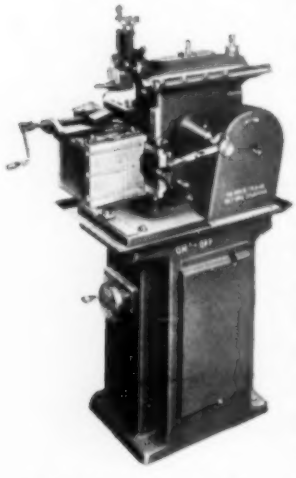
Swing Over Bed, 10½". Distance between Centers, 24".

NO ADVANCE IN PRICES

During the war years, prices in general advanced more than 40%. During the same period, Logan Lathe prices averaged approximately 15% increase, in spite of improvements in design and construction. Our enlarged plant, equipped with the most modern machinery makes for production savings which are passed on to the users of Logan Lathes. That is why even with recent material and labor cost increases, Logan Lathe prices remain unchanged.

Logan Lathe prices start at $159.50

LOGAN LATHES SAVE MONEY



LOGAN 7" SHAPER

Price naturally, has a bearing on the lathe you buy. Yet the low Logan price tag is only a one-shot saving. It is multiple, on-the-job savings, as well as price that makes Logan the lathe of true economy.

Logan on-the-job economies result from the way the Logan Lathe is designed and built. For example, due to its ball bearing spindle mounting, the Logan Lathe is ready for any operating speed from 30 to 1450 rpm, with no bearing adjustment. V and flat bed ways are machined to within .0005" of parallelism. Headstock bearing faces are held to an accuracy of .0005". Rugged, massive construction is combined with this accuracy, and vital wear points are protected by self lubricating bronze bearings. Consequently, even after years of constant use, a Logan Lathe retains power for heavy cuts, speed for low cost parts production, and accuracy for exacting tool room work. In many plants, batteries of Logan Lathes handle all medium and small work, saving in power costs, set-up time, and reduced rejects. In any shop, large or small, Logan sustained accuracy and versatility save time, materials, labor and money. See the complete line of Logan Lathes and Shapers at your near-by Logan dealer's, or write direct for catalog information.

DISTRICT OFFICES:

WOOLWORTH BLDG. NEW YORK 7, N. Y. CORTLAND 7-8024

550 W. WASHINGTON BLVD. CHICAGO 6, ILLINOIS CENTRAL 1246

1672 MISSION STREET SAN FRANCISCO, CALIF. UNDERHILL 6682

700 COMMERCE ST. DALLAS 2, TEXAS CENTRAL 4075

AA-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

NOW.. Mark Your Name Plates



QUICKLY

DISTINCTLY

ECONOMICALLY

Those blank spaces on your Name Plates can be filled in quickly and economically with serial numbers, lot numbers, dates, operating data, etc., with a Matthews Name Plate Stamping machine. Your name plate—and your product—will be enhanced by the neatness with which it is done.

Stamping machines are available for efficient integration in almost any production process or technique. If your need calls for a device other than those already made, we will be glad to engineer one to meet all your requirements.

Dies for letters, numerals, special marks and designs can be supplied to your order. For detailed information, write for Supplement E.

JAS. H. MATTHEWS & CO.

3933 FORBES STREET PITTSBURGH 13, PA.

BRANCH PLANTS

NEW YORK, BOSTON, CHICAGO, PHILADELPHIA, NEWARK, SYRACUSE

District Sales Offices: Cleveland, Cincinnati, Birmingham, Dallas



New Automatic Device Provides Up-to-the-Minute Visual Record

The new CHART-O-MATIC provides an instant visual record of all production, shipments, purchases, absenteeism, etc. Avoids inventory surpluses. Guides purchasing department giving constant picture of all parts and supplies on hand. Requisitions can be made direct from chart. Information from all departments transmitted to operator by Telautograph permits instant recording on CHART-O-MATIC. Does away with big wall charts and card-systems and tedious, time-consuming search for data that is often far from current. With the CHART-O-MATIC, the complete activities of the entire plant can be determined in an instant.



The New Chart-O-Matic

The entire unit is easily portable and operates from 110 volts current. Chart rotates in either direction by finger-tip control. Speed may be governed by rheostat.

New devices are proving their worth in saving time and reducing nervous tension on the job. And modern plants throughout America are finding that chewing gum on the job helps relieve monotony and helps to keep workers alert. That is why more plants every day are making Wrigley's Spearmint Gum available to their employees.



Complete details may be obtained from Spiral Mfg. Corporation, 3612 N. Kilbourn Avenue, Chicago 41, Illinois.

AB-75

Glenzer UTILITY Small Tool DRIVERS

COMPLETE LINE FOR ALL SIZES AND TAPERS



SAVE 40% and UP

on Your

SMALL TOOL COSTS

Straight Shank tools cost less than taper shanks—use Glenzer DRIVERS for the tapers—reduce tool chasing and costly down time. Lost production time now counts up faster than ever, with higher labor rates.

Proven on Production Jobs for Twenty Years

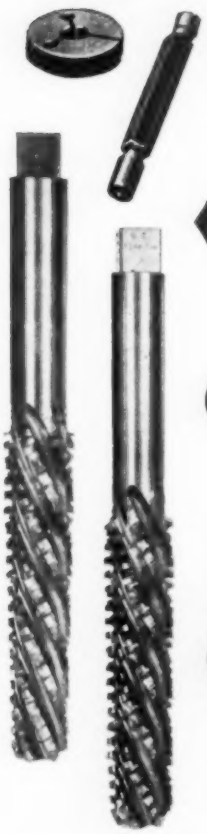
Ford, General Motors, Chrysler, General Electric, Westinghouse, International Harvester, Caterpillar Tractor—many others have been using these Glenzer Sleeves consistently since World War I. In many plants they are specified as standard.

Also Made for Republic Shankless Drills

Write for Complete Specifications and Prices

THE J. C. **GLENZER** CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.

STANDARD and SPECIALIZED



GAGES

To protect your constant investment in increasingly costly labor and materials, keep up to date on Gages. *Axelson* offers standard Gages from stock and will take care of your specialized needs.

SPECIAL TOOLS

Acme Taps and other special tools are available to your order. Made under most modern and scientific conditions, Axelson Gages offer long life and minimum wear.

AXELSON GAGES

AXELSON MANUFACTURING CO.
6160 So. Boyle Ave. (P.O. Box 98, Vernon Sta.), Los Angeles 11, California, U.S.A.





Save three ways with Grand Rapids No. 10-B Combination Tap and Drill Grinder:
1. Lower first cost; 2. Less maintenance expense;
3. Valuable floor space.

Write for Bulletin G.L. 8-46

Grand Rapids 10-B Combination Tap and Drill Grinder

GALLMEYER & LIVINGSTON COMPANY
Manufacturers of Grand Rapids Grinders
110 STRAIGHT ST., S.W., GRAND RAPIDS 4, MICH.



INCREASED PRODUCTION — Many manufacturers of cold-headed products report notable production increases, some up to 500%.

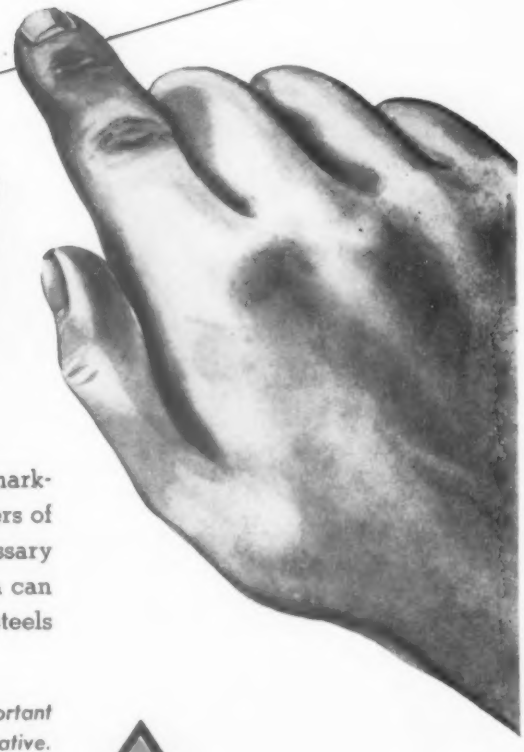
GREATER TOOL LIFE — Fabricators of light steel and wire products enthusiastically claim an improvement in tool life of as high as 350%.

ELIMINATION OF LOSSES — Manufacturers of cutting tools report a virtual elimination of losses due to non-uniformity of material.

their experience proves what you can expect

with **LATROBE**

DESEGATIZED
BRAND OF
Dispersed-Segregate STEELS



Some few months back when Latrobe first introduced this remarkable new development in high speed and die steels, many users of such steels had come to accept carbide segregations as a necessary evil. Today their experience is a sound indication of what you can expect from Latrobe's DESEGATIZED Brand Steels . . . steels which are free of harmful carbide segregation.

Latrobe's sales engineers will be glad to give you the facts on this important tool steel development. Write or call your nearest Latrobe representative.

5

LATROBE ELECTRIC STEEL COMPANY LESCO **LATROBE, PA.**

TOOL FOR PROFIT WITH

ELGIN Sapphire

WEAR RESISTANT

CROSS HEAD



★ Translates rotating to reciprocating motion in small mechanical device. Sapphire faced driver protects *both pieces* from wear, reduces noise and requires no lubrication whatsoever, anytime.

REFER D-17—SAPPHIRE SHORTS

RING GAGES



★ Outwearing steel and carbides more than 100 times. Abrasive resistant, dimensionally stable. *Proved* the absolute in gaging confidence; save time, eliminate gage checks.

REFER D-13—SAPPHIRE SHORTS

POISING TOOL



★ Sapphire edges maintain true alignment, lowest possible friction, resist corrosion and are easy to clean. Here's another way Elgin Sapphire helps increase salability and effectiveness of your products.

REFER D-19—SAPPHIRE SHORTS

WRITE FOR DETAILS AND ENGINEERING ASSISTANCE

Sapphire

PRODUCTS DIVISION

ELGIN NATIONAL WATCH COMPANY

AURORA • ILLINOIS

SPECIFY *Van Keuren*

WIRE TYPE PLUG GAGES

Tool Steel
High Speed Steel
Chromium Plated Carboloy



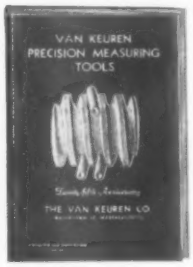
Wire Type Plug Gages were originated by the Van Keuren Co. in 1925. They are now in almost universal use for gaging small holes.

Longer lasting precision and lower gage cost are assured because the entire 2" length of the gaging unit can be used. When the end becomes worn, it is ground off and a new section of the original accuracy is moved out for use. The wire unit is securely held in the handle by a split bushing and a headless set screw.

Van Keuren Wire Type Gages are made to Class B accuracy +.00005" —.00000" on the Go units and ±.000025" on the No Go units. Closer or wider tolerances can be supplied if desired.

On your next order specify VK Wire Plug Gages. VK Carboloy for long runs because of the enormous saving in gage cost. VK Carboloy for fussy jobs because of the infinitesimal gage wear and insurance that the parts will be within the specified limits. VK Tool Steel—High Speed—Precision Chromium for less exacting jobs. You will be assured of the best in accuracy, quality and delivery.

The 160-page Van Keuren Catalog No. 33 gives full information on wire type plug gages and other precision measuring equipment. It also includes simplified formulas for measuring threads, splines, gears and worms. Your copy of this valuable handbook will be sent on request.



THE *Van Keuren* CO., 174 Waltham St., Watertown, Mass.

28th YEAR

Light Wave Equipment • Light Wave Micrometers • Gauge Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages.

SCHERR aids to precision

THE COMPARITOL



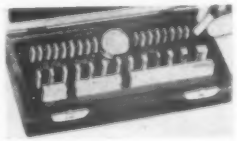
Where inspection accuracy to "Tenths" and better is absolutely essential in such parts as gages, threads, fine wires, cylindrical ground work, etc., the Scherr Comparitol will give indisputable results. It can be used by anyone with a few minutes' instruction, can be placed near machines for constant spot inspection, as well as used for final inspection. Long-lived patented knife-edge mechanism needs no oiling, has no gears, racks, multiple levers, pivots or bearings, no electrical connections, bulbs or transformers. Thousands in profitable use everywhere.



SCHERR DIAL INDICATORS

Last longer and cost less. Have an exclusive mechanism of extra sturdiness, with only three moving parts. No quick spinning wheels nor unhardened racks. Furnished with standard back or with ball-joint back for setting at any angle. Contact points for all needs. With clamp holder, extension bar, tool-post holder, in compact metal case.

ULTRA-CHEX GAGE BLOCKS



The last word in modern basic accuracy brought within the grasp of all shops large and small. Sets in size for all budgets. All blocks accurate to 5 millionths. Illustrated is the 34-block set, giving 80,000 combinations in steps of 1/10,000", with optical flat for checking wear. Low prices allow for constant practical shop use in setting tools, checking gages, locating holes in jigs and fixtures, etc. Many shops use a number of sets, with one master set for reference.

Write for full details on the above tools, and for the Scherr Small Tool Catalog.

GEO. SCHERR CO., Inc. 199-A LAFAYETTE STREET NEW YORK 12, N. Y.

Here's the Easiest, Quickest saving you ever made!



SIMPLY changing from your present carbide, to Improved TECO Cemented Carbide, will cut your turning, boring and facing costs to the bone. Improved TECO costs no more than ordinary carbides . . . but is producing 3 to 10 times more pieces per tool. It operates at higher speeds, heavier feeds, removes more metal, gives a better finish.

Try Improved TECO on any carbide job. Run as usual. Keep accurate check on the extra production you get. Then try it at higher speeds and feeds, for an additional surprise.

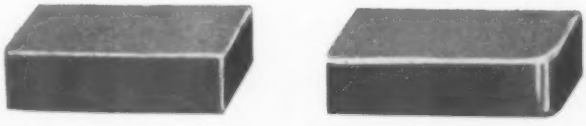
Send us details of your machining problem for recommendation. Latest catalog and price list sent on request.

TUNGSTEN ELECTRIC CORP. 570 39th ST., UNION CITY, N. J.

Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

Manufacturers of

TECO CARBIDE BLANKS and TOOLS



All standard sizes and styles. When ordering any carbide tools specify "Teco — no substitute"

STUDY THIS PERFORMANCE!

	ROUGH BORE	FINISH BORE
Part Machined:	Piston Ring (3¼" I.D.)	Same
Material:	Fine Grain Cast Iron	Same
Operation:	Rough bore	Finish bore
Machine:	Carbo Lathe	Same
Depth Cut:	.060 to .100"	.010 to .012"
Feed:	.015"	.0075 to .010"
Speed:	225 RPM	225 RPM
Pieces per grind:	10,000	10,000
Previous carbide:	2,500	2,500

R-119-A TECO Blank used.
TECO Grade A-1 *both* operations.

Improved
TECO
CEMENTED CARBIDE

For over a quarter century—manufacturers of Tungsten Carbide—from ore to finished material.

Recessing Tools . . .

for GROOVING, RECESSING, BACK FACING

Adaptable to Drill Press, Boring Mill, Turret Lathe, Automatic, Milling Machine, etc.

1—SHANK—to fit your machine,—threaded to driving sleeve.
2—DRIVING SLEEVE—A sliding fit to body shank.
3—STOP COLLARS—Adjust to control travel of cutter.
4—BODY.
5—CUTTER BLOCK—Travels in 1 to 1 ratio and at right angle to sleeve.
6—COOLANT HOLE—Permits flow of coolant or lubricant to cutter.
7—PILOT RETAINING COLLAR—Holds ball bearing pilot assembly to body.
8—PILOT—Made to your specifications, permits rotation of tool or work.
9—CUTTER—Made to your specifications for material and work piece.

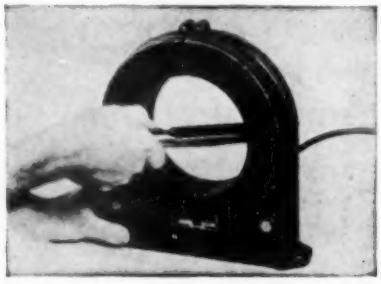


Cuts one or more grooves any shape or form. Takes cuts at unusually high feeds.

No. 1—Cap. 5/8" to 1" Hole; Std. Shank, No. 3 Morse
No. 2—Cap. 1" to 2" Hole; Std. Shank, No. 4 Morse
No. 3—Cap. 2" to 3" Hole; Std. Shank, No. 5 Morse
No. 4—Cap. 3" to 4" Hole; Std. Shank, No. 5 Morse

Demagnetizers . . .

for easy demagnetizing of tools or parts



Just pass the tool or part through the opening of a 6" "Through Type" Demagnetizer and remove to a distance of one or two feet, before turning off the current. To speed up production, work can be dropped through by gravity. Operates on 110 volts—60 cycles. No moving parts. Other standard sizes from 4" x 24" to 18" x 24".

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The most practiced hand cannot judge to perfection the exact tension of every bolt or stud . . . by touch. That's why more and more particular craftsmen are using JO LINE torque wrenches. (Ranges to 1600 inch/pounds).

Wrench shown has 130 different instantaneous torque settings. All are accurate within 3% plus or minus 2 lbs. Break comes by automatic impulse, unerringly true to specifications. The perfect union of parts is speedily accomplished, even by the untrained. There are no dials to watch so the wrench may be used overhead, or in any position convenient.

Sturdily built, all torque control features are metal encased. No other wrenches in this class are as light in weight and as easy to handle as the JO LINE.

Catalog gives wrench specifications and complete line of adaptors. Tables of suggested torque values in various kinds of assembly are also given.



"Precision tight
Means it's right."

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8442 OTIS ST., SOUTH GATE, CALIF.



Crobalt Quality



Crobalt is a hard alloy (containing principally chromium, cobalt, tungsten, vanadium, zirconium and carbon), cast in the form of tool bits and inserted milling cutter blades especially developed for high speed production. At high temperatures (up to 2000 degrees) Crobalt cutting qualities remain constant.

The cutting edges of a Crobalt tool stay sharp longer, and thus assure you of much greater tool life between grinds. This automatically increases production by reducing "Down-time" ordinarily required for changing of tools. Try Crobalt in your shop.

CARBIDE TIPPED
Inserted Milling Cutter Blades

Crobalt now fabricates carbide tipped inserted milling cutter blades. Any make of tungsten carbide can be furnished. Prices for this type of blade are unusually low and the product and finish are unexcelled. We manufacture blades of all types and sizes. Send us your prints for quotation.

Crobalt Inc.

1351 N. Main St. Ann Arbor, Mich.

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When you specify EX-CELL-O Grinding Spindles—for new equipment or as replacement—you get a spindle definitely designed and manufactured for *precision* work, one that will keep your grinder operating smoothly and at top efficiency. . . . For a quarter of a century EX-CELL-O spindles have been the favorite of numerous grinder and other machine tool builders. . . . If you want to get the utmost in grinder performance, be sure to specify EX-CELL-O Grinding Spindles—with *sealed-in lubrication!*

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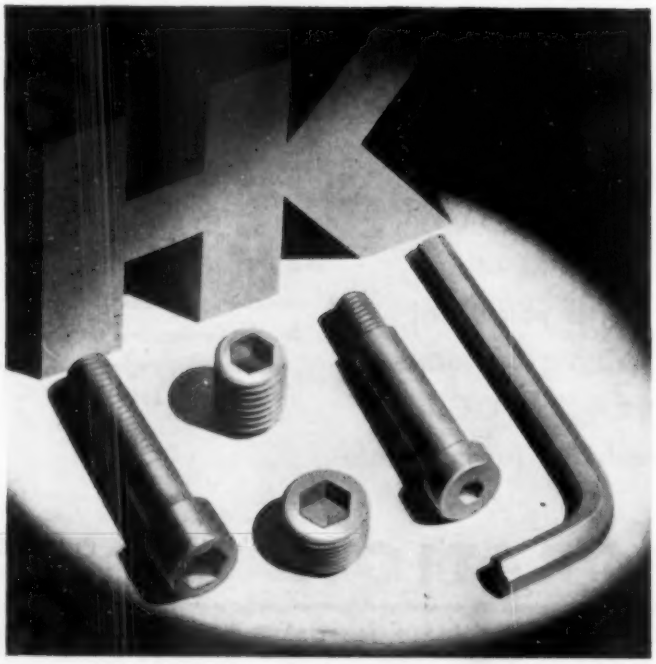
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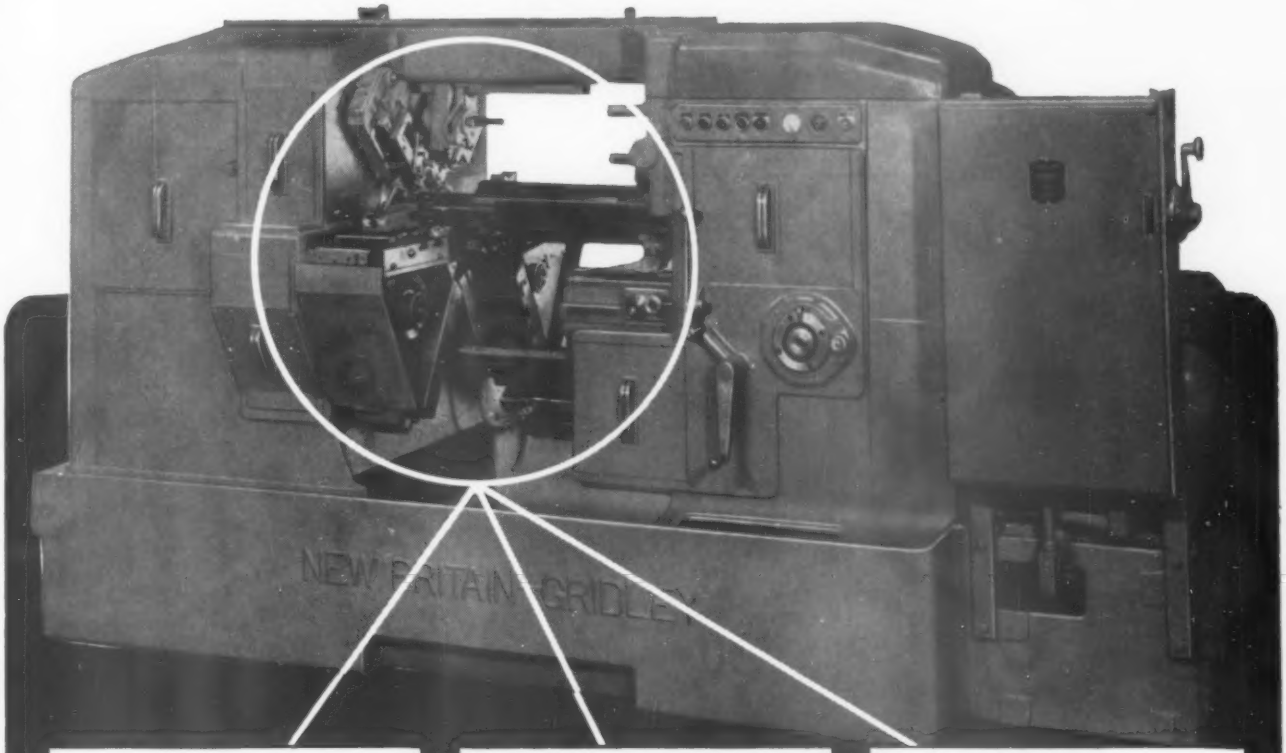
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Answers the Need for Lower Costs and Higher Productivity



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2. No cam to change when adjusting stock feed-out length.
3. Cross slide cams directly behind slides minimizing linkage. Remove three screws with cover and cams pull off.
4. Micrometer adjustment in both directions on all cross slides, all independent of stops.

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1. Five heavy-duty forming slides and cut off slide evenly spaced about carrier making line of forming thrust identical in each position.
2. Tool holders interchangeable among forming slides, also on main tool slide.
3. Greatly increased chip clearance and capacity so essential with carbides.
4. Flexibility for auxiliary threading attachments. Accelerating drives in every position.

FOOLPROOF, AUTOMATIC OPERATION

1. Shoulder height, complete control panels at front and rear of machine.
2. Automatic stop shuts off machine and flashes red light when spindle is empty.
3. Program wheel on outside of powercase shows complete cycle of machine.
4. Machine stops if lubricating oil pressure is low.
5. Gage indicates when machine is operating at other than normal load.

Fast, powerful machines which will outperform anything modern tools will handle and anticipate future tool developments. These new machines with their initial and permanent accuracy also incorporate all the previous exclusive features by which NEW BRITAINS are recognized. To these qualities have been added new features, making it possible to accomplish quick setups where short runs are the rule. Built massive to handle the horsepower required for steady feeds for carbides on tough forming steel jobs, they are also designed for super high-spindle speeds, essential for brass and aluminum. Six spindles up to 2¼" capacity.

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M-01062





One lever controls 16 spindle speeds

IN THE NEW LeBLOND 16" MODEL RT HEAVY DUTY LATHE

MODEL RT STANDARD FEATURES:

- Single lever controls 16 spindle speeds ranging from 20 to 1025 rpm, or 30 to 1537 rpm.
- Combination gear-belt drive headstock
- All main drive gears hardened and ground
- Universal power rapid traverse moves carriage, cross slide, and tailstock
- Feed box totally enclosed, automatically lubricated
- Flame hardened and ground steel bed ways front and rear
- One-piece apron with single lever control and positive jaw feed clutch; automatic lubrication
- Thrust-lock tailstock with worm and rack construction; full length bearing for spindle; direct reading spindle travel dial
- Deep steel chip pan, automatic length stops, tool storage lockers, and many other features.

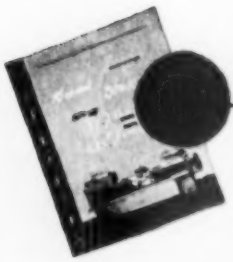
Built to meet the metal working industry's need for increased productivity of both man and machine, LeBlond's new Model RT actively aids and encourages operators to produce more and better work. It has everything: speed, power, accuracy, versatility. Your operators will like it because it's so easy to run and maintain. You'll like it because it will perform profitably so many different kinds of work: production, tool room, experimental, maintenance.

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